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Use of the GOES/DCS for Data Collection in Remote Areas

prepared for

The Office of Scientific Systems Development

Bureau of Land Management

Denver, Colorado

Dale Vance

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Michael L. Exner

Consulting Engineer

April 22, 1977

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I. INTRODUCTION

The purpose of the study reported herein was to evaluate the use of the Geostationary Orbiting Environmental Satellite (GOES) Data Collection System (DCS) for data collection purposes in remote areas. In particular, to study the problem of returning satellite relayed data to the end user in the field and as a "worst case", to a field user in Alaska.

Although the study was focused specifically on the use of the GOES-West spacecraft (S/C) for collection of realtime fire control meteorological data in Alaska, many of the conclusions drawn and recommendations made apply equally well to GOES/DCS users with other purposes. In particular, as will be shown in later sections, the study results are applicable to all GOES/DCS users in Alaska.

II. SUMMARY OF FINDINGS

Due to the practical constraints dictated by BLM schedules and budgets, Synergetics recommends the use of the standard National Environmental Satellite Service (NESS) Data Collection System/Data Processing System (DCS/DPS) for 1977 operations. The 1200 baud dial-in line should be used with a Texas Instruments' model TI 742 data terminal and recorder for reception and logging of data. Federal Telephone System (FTS) lines may be used for the communications link to the DCS/DPS in Marlow Heights, Maryland.

For future operations (after 1977), Synergetics recommends the procurement of a stand-alone earth terminal for direct reception of Data Collection Platform Radio Set (DCPRS) data relayed through the GOES. It will be shown in the following sections that such a terminal is not only feasible, but is simultaneously the least expensive and most reliable approach to completing the circuit to a field sight in Alaska.

III. SYSTEM DESCRIPTION OF THE GOES/DCS

The GOES/DCS is a synchronous satellite based communications system for the collection of a large variety of geophysical data obtained from virtually any point on the Western Hemisphere. While this report and system description are concerned only with the DCS portion of the GOES system, it is important to keep in mind that the S/C and the Command and Data Acquisition Station (CDA) have several missions. The GOES system provides the following functions:

1) The VISSR System has a visible and infrared spin-scan radiometer that views the earth's cloud cover and surface and transmits the data to earth.
2) The Stretched VISSR System transmits processed VISSR data to Data Utilization Stations via the GOES satellite.
3) The WEFAX System transmits weather facsimile cloud cover pictures to users via the GOES satellite.
4) The SEM System performs space environment monitoring and transmits particle energy and trajectory data to the Boulder, Colorado Space Disturbance Forecast Center.
5) The DCS System relays data from both self-timed and interrogated DCPRS units to the CDA. The DCPRS units usually interface with ships, buoys, rain gauges, river level gauges, seismographs, etc.
6) The CDA Command and Telemetry System enables the CDA to both configure the satellite and monitor its status.

The DCS is of interest for this report and is therefore described in more detail below.

A complete communications link from a set of remote sensors to a user employing the GOES/DCS normally will consist of the following elements:

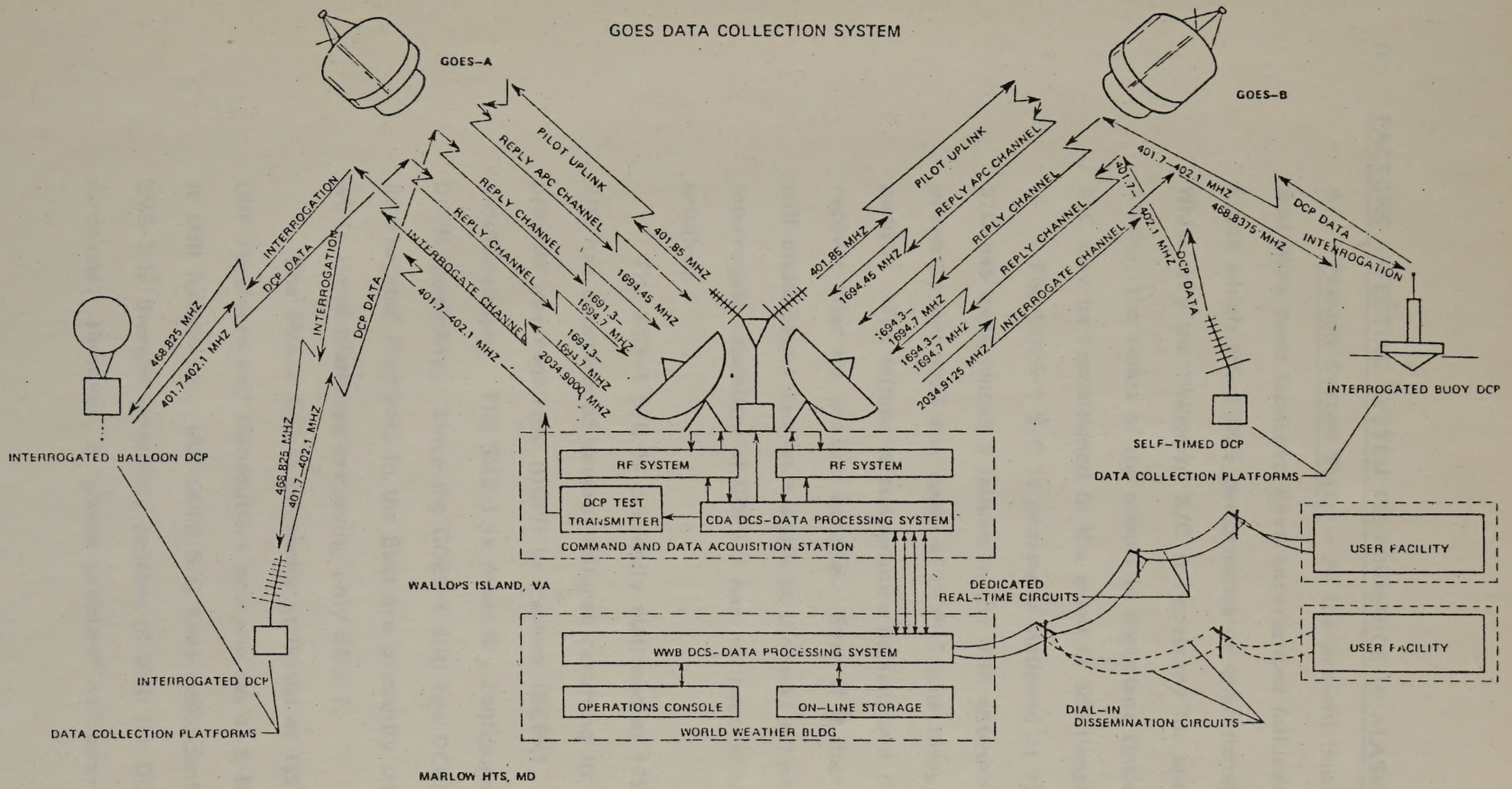
1) A DCPRS - this unit converts sensor data to a 100 bit/second Manchester encoded serial data stream, phase modulated on a UHF (402 mHz) carrier at an EIRP of approximately +50 dBm.
2) A UHF to S Band transponder in synchronous earth orbit - this subsystem of the GOES S/C receives the DCPRS signal, upconverts it to 1694 mHz, and retransmits the signal to an earth receiving system.
3) The CDA Station - this is the GOES earth station located at Wallops Island, Virginia. Signals relayed through the S/C are received by a large parabolic antenna, amplified, down-converted, demodulated, and multiplexed together with nine (9) other DCPRS channels. A 16 bit minicomputer receives up to eight (8) multiplexer outputs (80 channels) and formats the data for transmission over dedicated, conditioned, leased land lines to the DCS/DPS.
4) The DCS/DPS - this is a large scale computer system in Marlow Heights, Maryland (NESS offices), which receives all DCPRS data from the CDA. The DCS/DPS carries out the multiple functions of scheduling all activity within the DCS, performing error checks on the data, disseminating the data, maintaining performance histories on individual DCPRS units, and performing routine system tests to identify failures within the system itself.

Users may communicate with the DCS/DPS over either dedicated realtime land lines, or via one of two dial-in (user demand basis) circuits operating at 110 baud or 1200 baud.

5) A data terminal - this is the final hardware element required to complete the normal communications link from a DCPRS. The terminal can be as simple as an ASR-33 teletype, or as complex as a post processing computer system, depending on the volume of data and processing requirements.

While the two land line circuits mentioned in the above discussion (CDA to DCS/DPS and DCS/DPS to user) are not specifically called out as separate elements of the system, it is very important to recognize each as additional complex serial elements required to complete the normal DCS communications link. Each contributes to the overall noise on the data and to the overall level of system reliability.

Figure 1, illustrates the entire system in block diagram form. For additional information on the standard GOES/DCS, refer to the NESS Users Interface Manual for the GOES/DCS. This manual is available from NESS, Marlow Heights (Bill Mazur FTS 763-2724).



GOES/DCS SYSTEM DESCRIPTION

Figure 1

IV. FACTORS AFFECTING SYSTEM PERFORMANCE IN ALASKA

A. Present System Status - At the present time, all three S/C that have been launched have experienced failures of various kinds which affect DCS performance or operational procedures. While only the "Western" S/C is necessary for operations in Alaska, the status of the others is important since the other S/C may be repositioned in the event of additional failures.

The GOES-1 S/C is presently stationed at 75°W. This S/C has experienced a failure in the UHF antenna system which presently prevents any relay of DCPRS data through the transponder. The failure is temperature related and the S/C may recover after the present eclipse. Even if it does recover, it will undoubtedly fail once again at the next eclipse. The interrogate capability of GOES-1 has not been affected by the problem.

The SMS-1 S/C is presently stationed at 105° W. This S/C has experienced several failures resulting in its ability to provide interrogations (DCPI) or replies (DCPR), but not both simultaneously. The SMS-1 is presently configured to provide DCPR capability. Since the GOES-1 still has DCPI capability, interrogated platforms in the East are presently using both S/C while timed platforms are using only SMS-1.

The SMS-2 S/C is presently stationed at 135° W. Both UHF receivers and transmitters and one set of S-Band equipment is still functional. (All GOES S/C have redundant DCS hardware.) SMS-2 is therefor presently capable of both the DCPR and DCPI functions. However, a "power problem" has been predicted for

this summer. It is projected that the power output of the solar array will drop much more than it did last summer. If this occurs, the DCPI may be down as much as eight hours per day. The DCPR function will not be interrupted. (NOTE that only the DCPR is required for timed platforms.) This condition is expected to occur for approximately 1 month before and after the summer solstice.

SMS-2 also has a "spur problem" apparently related to the UHF receiver DC-DC converter. The problem manifests itself as five or six strong spurs in the received DCPR passband. These spurs tend to drift slowly with time and temperature across various DCPR channels. Mr. Cy Settles, at the Wallops CDA, prepared a spur prediction chart to predict which DCPR channels would most likely be affected and when. This chart will be updated this month (April 1977). A copy will be available from Cy (FTS 8-925-3446).

BLM should select a channel for the two LaBarge platforms which is expected to be least affected by the spurs. Synergetics recommends the use of channel 69 for minimum probability of interference.

The fourth S/C is presently planned for launch May 27, 1977. While no decision will be made on where it will be stationed until after launch, it probably will replace GOES-1 (75^{o} W). In any case, SMS-2 is expected to stay in its present location since it is the healthiest of the three S/C at this time.

The CDA now has redundant hardware to support the DCS and all systems are operating fairly well. A recent set of tests were performed to isolate some problems being experienced

by some users. The results indicated some hardward problems in the DCP's and in the CDA demodulators. These have been corrected. There were no problems detected with the user's facilities, the leased lines, or the DCS/DPS.

The new computer system at Ness (DCS/DPS) was scheduled to become operational 15 April 1977. A user interface manual describing use of the new system is attached to the original of this report.

B. UHF DCPR Link Performance - The DCPR link to Sms-2 was analyzed in detail (see Table 1) and found to have over 10 dB of margin providing scintillation contributes no more than 2 dB additional path loss and multipath is neglected. Both of these assumptions should be valid more than 95% of the time. If platforms using high gain antennas are placed on "level" ground, or ground sloping gently to the south, multipath should be negligible. In addition, platforms should not be placed directly across a body of water from the S/C, i.e., to the north or northwest of a lake, etc.

Scintillation losses have been estimated for the GOES/DCS and some experimental data has been taken. Unfortunately, actual scintillation losses at 400 mHz from high latitudes are still unknown. Practical experience on several Alaskan platforms indicates that losses due to this phenomenon are well within the expected margin. The 2dB scintillation loss accounted for in Table 1 should be conservative most of the time. However, during certain times of the year, losses may be much higher for short periods of time.

Prior to any large scale deployment of DCPRS units in high latitudes, a test should be conducted to pin down the effect of

TABLE 1

DCPR LINK PERFORMANCE FROM POINT BARROW, ALASKA
(UHF LINK)

1.	DCPRS Power Output (7 Watts)	+ 38.5 dBm
2.	Tx line loss	- 0.5 dB
3.	Tx antenna gain (Synergetics 402-11-1)	+ 13.0 dBic
4.	Tx antenna off-beam loss	0.0 dB
5.	Net DCPRS EIRP	+ 51.0 dBm
6.	Free-space loss (9^{o} elevation angle)	- 176.7 dB
7.	Scintillation loss (99.5%)	- 2.0 dB
8.	Polarization loss (worst case)	- 0.5 dB
9.	S/C antenna off-beam loss	0.0 dB
10.	S/C antenna gain	+ 3.8 dB
11.	S/C Rx line loss	- .8 dB
12.	S/C Rx Signal level	- 125.2 dBm
13.	Noise sources	
	a) Thermal ($T = 360^{o}K$)	- 173.0 dBm/HZ
	b) Man Made (estimated, average)	- 178.0 dBm/HZ
	c) Adjacent channel crosstalk (S/N)	- 26.6 dB
	d) Total noise power density	- 168.8 dBm/HZ
14.	C/N_o at S-Band Tx output	+ 43.6 dB-Hz
15.	C/N_o required for BER of 10^{-4}*	+ 32.0 dB-HZ
16.	Margin*	+ 11.6 dB

*Assumes 1 dB degradation to C/N_o due to noise from the S-Band down link.

scintillation on the UHF link. This test should consist of measuring the received C/N_o at the CDA (or other S-Band receiving station) for a constant DCPRS EIRP over a period of one year. Measurements should be recorded automatically eight times/day using 30-second average values of received signal strength and UHF pedestal noise power density. Such a test should identify all variations due to scintillation except those associated with long term (primarily the "11 year cycle") sun spot activity.

In conclusion, the DCPR link should perform as well from Alaska as from lower latitudes most of the time, although scintillation will undoubtedly cause more variation in the UHF received signal level than in the lower forty-eight. The computed margin should be more than adequate to cover all but the most intense scintillation disturbances. In addition, adjacent channel noise is down over 15 dB from the required S/N.

V. OPTIONS FOR COMPLETION OF THE DATA LINK FROM THE S/C TO ALASKA

Nine alternative methods of receiving DCS relayed data were investigated. Each method was evaluated both with respect to immediate requirements (1977 field season) and long term requirements (operational). Results are summarized in Table 2.

1. Hard Copy Mailed from NESS - This method is obviously unacceptable for the operational mode, but was investigated for possible use this summer. Even for experimental use, this method would be too slow. (3 - 5 days by best method.) In addition, NESS officials were very pessimistic about providing such a non-standard service, at least without additional funding and much paper work.

2. Computer Compatible Media Mailed from NESS - This method has considerable advantage over hard copy, but is still slow. The same pessimism at NESS applies here.

3. One NESS official suggested the possibility of retransmitting the data through the GOES S-Band transponder for reception in Alaska (or elsewhere) at 469 mHz. Although this is technically possible, the addition of a third carrier through the transponder (the domestic and international interrogation carriers are passed through this transponder) would degrade an already marginal link to interrogated buoy DCPRS units. Such a system would also require a considerable effort to interface at the CDA. In any case, NESS would almost certainly turn down any request to support this method.

TABLE 2

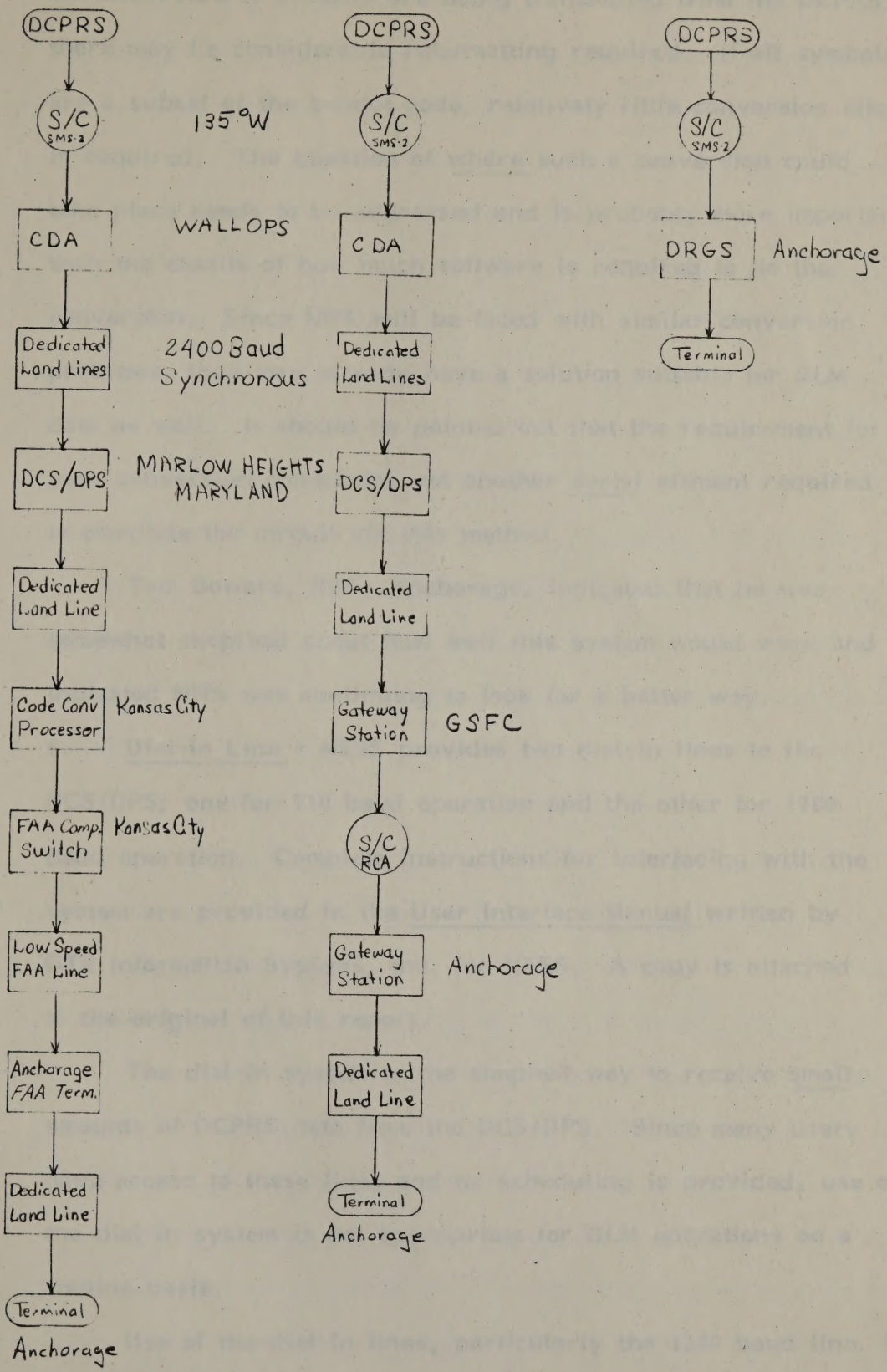
Option	1977	Operational	Comments
1. Hard copy mailed from NESS	NO	NO	Non-Standard service for NESS
2. Computer compatible copy mailed from NESS	NO	NO	Non-standard service for NESS
3. Retransmission through GOES from DCA	NO	NO	Technically possible, but would not be authorized
4. Shared NESS line to Gilmore Creek	NO	NO	Technically possible, but would be difficult to implement. Availability after TIROS-N uncertain
5. Shared NWS/FAA line to Anchorage	NO	YES	Technically possible, NWS would cooperate, but has reliability problems--requires code conversion to 5 bit baudot code.
6. Dial-in line - ~~FTS~~ or Commercial	YES	NO	Only reasonable alternative for 1977, but unacceptable for operational use due to manual intervention requirements.
7. Leased Commercial Land Line	NO	NO	Economically unattractive - satellite links more reliable for less cost.
8. Leased Commercial Satellite link	NO	YES	Could not be implemented in time for 1977, but O.K. for operational use. More reliable than FAA shared line, but still complex - High monthly cost - $36,000/yr.
9. Direct readout ground station in Anchorage	NO	YES	Unavailable in time for 1977 - would require minimal development - most reliable method. No monthly costs - low maintenance - complete data format freedom. Could be portable.

4. Shared Space on NESS Data Lines to Gilmore Creek. Several conversations with Bob Laudrill, NESS, Washington were held concerning the possibility of sharing existing NESS data lines to Gilmore Creek. These lines are used to support various polar orbiting satellite systems. Although Mr. Laudrill indicated NESS support might be possible, he was generally unfavorable toward such an arrangement. For one thing, the entire communication link to Gilmore Creek is in the process of changing over to a new system for support of the TIROS-N S/C. The availability of any support after the TIROS-N program is uncertain. In addition, land line charges from Gilmore Creek to Anchorage could be as high as $500/month.

5. Shared Space on NWS/FAA Line to Anchorage - The National Weather Service (NWS) has arranged to transmit their DCPRS data to Anchorage over an FAA low speed terrestrial data link from Kansas City. A commercial leased line is used to tie the FAA computer in Kansas City to the NESS DCS/DPS computer. NWS officials in both Anchorage and Washington indicated a willingness to support the BLM using this circuit. Although this method is workable and apparently available (at least for the long term requirement), it has some technically undesirable drawbacks.

A block diagram of the complete data circuit using the FAA line is given in Figure 2. Because the data must flow through a large number of major serial components, the overall reliability of such a system will be relatively poor. In addition, the DCS/DPS data formats are not compatible with low speed line formats. Therefore, the data must be converted to five level baudot code for transmission from Kansas City. Depending

BLM OPTIONS FOR COMPLETING GOES/DCS DATA LINK

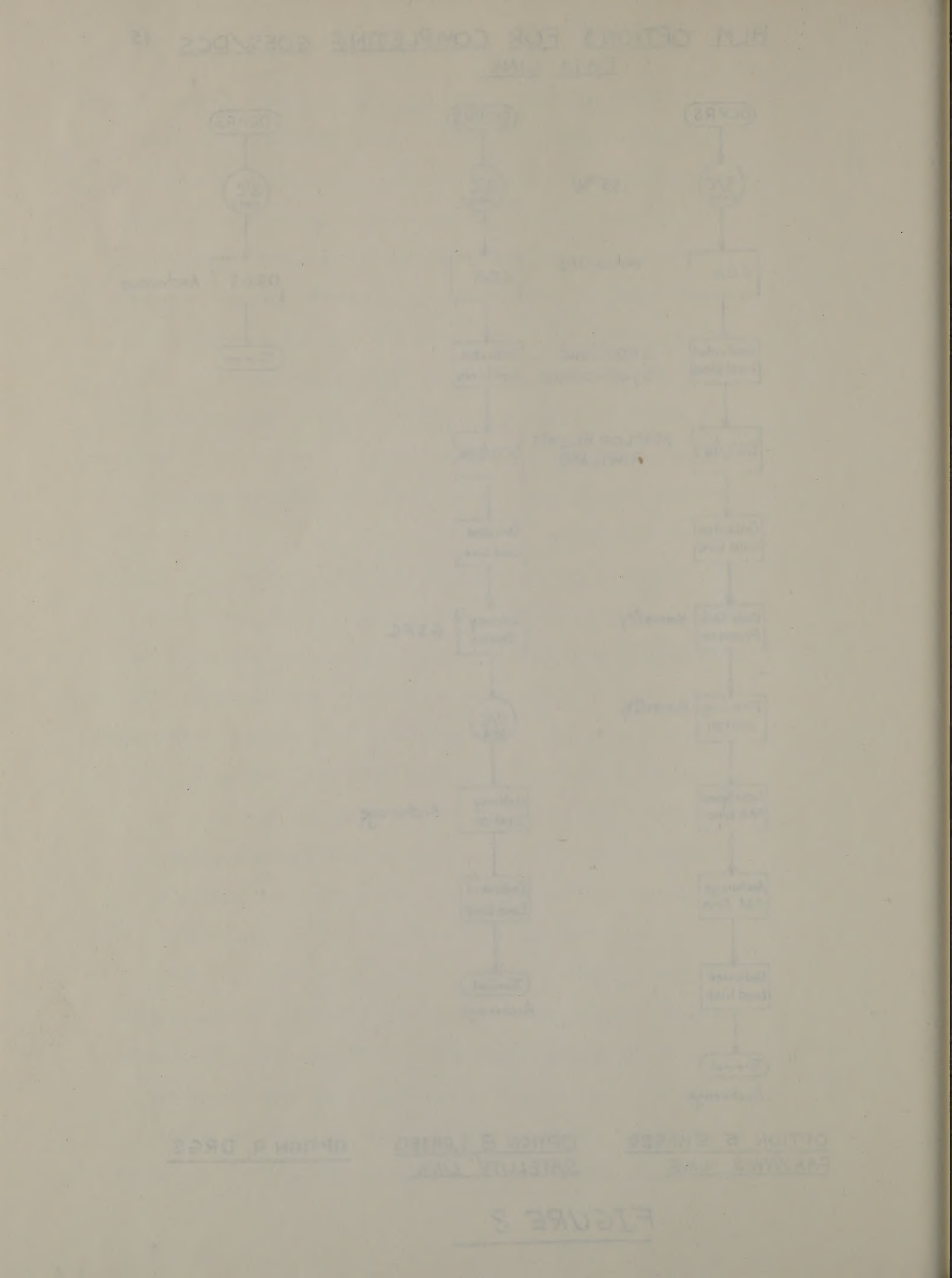


OPTION 5, SHARED FAA/NWS LINE

OPTION 8, LEASED SATELLITE LINK

OPTION 9, DRGS

FIGURE 2



on which ASC II symbols are being transmitted from the DCPRS, there may be considerable reformatting required. If all symbols are a subset of the baudot code, relatively little conversion effort is required. The question of where such a conversion could take place needs to be addressed and is probably more important than the details of how much software is required to do the conversion. Since NWS will be faced with similar conversion problems, they may already have a solution suitable for BLM data as well. It should be pointed out that the requirement for code conversion constitutes yet another serial element required to complete the circuit via this method.

Tom Bowers, NWS, Anchorage, indicated that he was somewhat skeptical about how well this system would work and indicated NWS was continuing to look for a better way.

6. Dial-in Line - NESS provides two dial-in lines to the DCS/DPS; one for 110 baud operation and the other for 1200 baud operation. Complete instructions for interfacing with the system are provided in the User Interface Manual written by GTE Information Systems, Inc. for NESS. A copy is attached to the original of this report.

The dial-in system is the simplest way to receive small amounts of DCPRS data from the DCS/DPS. Since many users have access to these lines and no scheduling is provided, use of the dial-in system is not appropriate for BLM operations on a routine basis.

Use of the dial-in lines, particularly the 1200 baud line, is, however, very well suited for the 1977 experimental operation. For

this period, true realtime capability is less important than implementation simplicity and minimum cost. When necessary, near real time performance can be achieved using the dial-in method, although this requires manual operation. Since the total data volume for one day from two platforms can be transmitted in under one minute, there will be no problem establishing a connection and receiving a full day's data with a single call.

The 1200 baud circuit has an error correcting protocol which should provide essentially error-free transmission of the data from the DCS/DPS. The 110 baud circuit has no error correcting capability. Since a primary objective of the 1977 operation is to establish the reliability of the GOES/DCS, it is important to minimize or at least isolate external error sources such as the dial-in circuit. Synergetics therefore recommends that the 1200 baud dial-in facility be used for 1977 operations.

The protocol used by the DCS/DPS over this circuit is that used in the Texas Instruments Model 742 data terminal. This terminal can be purchased for approximately $4,925.

7. Leased Commercial Land Lines - Low speed data lines over terrestrial links are theoretically available from ATT/RCA. However, due to the ready availability of voice grade satellite links at lower cost, RCA discouraged pursuit of this approach. A satellite link should be more reliable as well as being cheaper.

8. Leased Commercial Satellite Link - RCA Alaskom (Linda Ward FTS #399-0150/commercial #907 276-6811) quoted a price of $2,700/MO for a single voice grade channel from an Anchorage gateway station to either California, Pennsylvania, or New York

gateway stations. Leased ATT land lines would be necessary to complete the link to NESS. The total monthly charges should be under $3,000 for either of the eastern gateways.

Al Brandt, at ATT Washington (202-457-3616), indicated RCA has applied for a license to build a gateway station at Goddard Space Flight Center (GSFC). If this facility is built, total monthly charges might be as low as $2,800.

A dedicated voice grade link could handle far more data than the BLM presently anticipates collecting. Twenty DCPRS units reporting hourly produce an average equivalent of less than 5 Bits/Sec. Therefore, time sharing the channel with other agencies using DCP'S in Alaska would seem highly appropriate.

Considering the procurement cycle time and lead time to engineer the total link, a leased satellite circuit is impractical for operations this summer. For operational use, this method should be given some consideration. Of all the "standard" techniques for returning data to Anchorage, a leased voice grade satellite link from GSFS to Anchorage appears to be the least expensive method with acceptable realtime and reliability performance.

9. Direct Readout Ground Station (DRGS) - Although they cannot yet be termed a "standard" technique for receiving GOES relayed data, the use of a complete stand-alone earth terminal is gaining considerable interest among DCS users. At least four such facilities have been built to date with good results. The first system, using an 18' antenna, was built for the National Data Bouy Office (NDBO) at Bay St. Louis, Mississippi. A similar system using a 30' antenna was installed at Vicksberg, Mississippi for the Corps

of Engineers. A DRGS was built at White Sands Missile Range, New Mexico, primarily for direct reception of VISSR data. This system can also receive DCPRS signals.

The newest system is under construction by S.E.D. Systems, Saskatoon, Saskatchewan, Canada. The project engineer, Mr. Dale Benjamin, was very helpful in establishing the requirements for a DRGS for the BLM in Alaska. The S.E.D. system is scheduled to be finished May 1977. Mr. Benjamin has indicated a trip to inspect the system, and possibly to make some measurements, might be arranged by contacting the Canadian Government.

DRGS'S have numerous advantages over the use of the "standard" facilities. The most significant advantage is the simplicity offered by this approach. A properly designed DRGS will provide far greater system reliability than the maze of telephone lines, multiplexors, computers, etc., required to complete the DCS/DPS loop.

In any communications system, the number of serial processes the data must flow-through will ultimately determine the overall system reliability. Inspection of Figure 2 reveals the advantage of the DRGS over the other methods. For either Option 5 or Option 8 to be as reliable as Option 9, every process below the CDA station would have to be 100% reliable, clearly wishful thinking!

A review of the minutes from the GOES/DCS Technical Working Group meetings indicates the considerable complexity of coordinating data formats between the many diversified user requirements. A DRGS allows the user virtually complete

freedom to optimize the entire data collection system around his requirements instead of around the combined requirements of many users.

Another important consideration is that of maintaining system performance. With either Option 5 or Option 8, much of the responsibility and control over elements of the system will be in the hands of other companies and agencies. Fault detection and correction therefore requires not only isolation of the defective system element, but doing so through relatively formal requests for assistance from other organizations. In other words, Options 5 and 8 are not only technically complex, they are politically complex.*

Given the apparent advantages of the DRGS, one might ask the question, why doesn't everyone use this method? The reason is primarily due to the widely held misconception that a receiving station of Wallops Island proportions is required to recover signals from the S/C. Referring back to Table 1, it would seem that the available margin on the UHF link ($\approx$ 12 dB) would imply that the receiving station sensitivity could not be reduced more than 10 or 12 dB without reaching theoretical performance limits. However, the ultimate S/N is not determined uniquely by the S/N available at the S/C. The C/N_o on the S-band link is just as important.

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*The author wishes to make clear that this statement is not meant to imply any lack of cooperation by NESS, FAA, NWS, RCA, ATT, or any other organization. It is simply an observation of fact. NESS personnel, in particular, have done a truly outstanding job to insure a reasonable system reliability given the complex task at hand. Their efforts are to be commended. The wisdom of becoming unnecessarily entangled in the complexity remains a valid question. --MLE

Table 3 gives the S-band link budget for the SMS-2 S/C to Wallops Island. The combined S/N is then determined by adding the noise contributed by both the UHF and S-band links. The UHF link noise is clearly dominant. In fact, a reduction in S-band C/N_o of 24 - 30 dB, depending on channel loading, would be required to reduce the overall S/N to the minimum required (+11 dB for BER = 10^{-4}).* Allowing for a 4 to 5 dB increase in the Receive System noise temperature (due to lower antenna elevation angle and the use of a simple FET antenna preamplifier), a 6' parabolic antenna is theoretically adequate for a BER of 10^{-4}, assuming all 40 channels are occupied.

For operation from Alaska, the S/C S-band antenna gain will be down approximately two additional dB. Scintillation is nearly negligible at this frequency. Thus a 10 foot antenna should be adequate for direct reception of DCP's in Alaska from SMS-2.

A complete UHF and S-Band combined link analysis is given in Table 4. Note that this analysis assumes a power sharing loss for 40 channels. Since more than 10 channels are rarely occupied simultaneously, some additional margin can be counted on most of the time.

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*Reference 8

TABLE 3

S-BAND LINK PERFORMANCE - SMS-2 TO WALLOPS ISLAND CDA

1.	S/C EIRP	+ 56.2 dBM
2.	Transponder Power Sharing Loss*	- 31.5 dB
3.	Off Beam Center Loss	0.0 dB
4.	Free Space Loss	-188.5 dB
5.	Polarization Loss	- .2 dB
6.	CDA Rx Antenna Gain (60')	+ 46.8 dB
7.	Off Beam Center Loss	- .4 dB
8.	Rx Line Loss	- .4 dB
9.	Rx Imput Power Level	-118.0 dBm
10.	Rx System Noise Temp ($80^{o}K$)	+ 19.0 dB-^{o}K
11.	Rx System Noise, N_o	-179.6 dBm/Hz
12.	Rx Input C/N_o	61.6 dB-Hz

* Power Sharing Loss for one DCPRS through the transponder, including -2.5dB additional loss due to UHF spin modulation. The power sharing loss with 40 channels each occupied by +51 dBm DCP'S will be -38 dB, for a C/N_o of +55.1 dB - Hz.

TABLE 4

COMBINED LINK ANALYSIS FOR 10' S-BAND ANTENNA
RECEIVE SITE ANCHORAGE

1.	S/C EIRP	+ 56.2 dBm
2.	Transponder Power Sharing Loss (40 channels)	- 38.0 dB
3.	Off Beam Center Loss	- 2.0 dB
4.	Free Space Loss (elevation angle 19^{o})	-189.0 dB
5.	Polarization Loss	- 0.2 dB
6.	Rx Antenna Gain (10')	+ 31.9 dB
7.	Off Beam Center Loss*	- 1.0 dB
8.	Rx Line Loss	- .5 dB
9.	Rx Input Power Level	-141.9 dBm
10.	Antenna Temperature	40^{o}K
11.	Preamp Temperature (N.F. $\leq$ 2dB)	170^{o}K
12.	Misc. Noise Temperature	20^{o}K
13.	Total Rx System Noise	-175.0 dBm/Hz
14.	Rx Input C/N_o	+ 33.1 dB-Hz
15.	UHF C/N_o (from Table 1)	+ 43.6 dB-Hz
16.	Combined C/N_o	+ 32.7 dB-Hz
17.	E_b/N_o @ 100 bits/sec.	+ 12.7 dB
18.	Required E_b/N_o for 10^{-4}	+ 11.0 dB
19.	System Margin	+ 1.7 dB

*Maximum for $\pm 1^{o}$ S/C movement and a fixed position 10' receive antenna.

A complete DRGS block diagram is given in Figure 3. Hardware is available from several sources to implement all functions. Data sheets are included in the Appendix.

The cost of such a system is estimated to be as follows:

1.	Antenna including heated radome, feed, mount, and installation	$10,000
2.	Preamp	$ 900
3.	Cables	$ 500
4.	Receiver	$ 3,000
5.	Demodulator	$ 6,000
6.	Micro-processor-programmed	$ 7,500
7.	Terminal or display device (TI 742 can be used)	$ 5,000
8.	Cabinets, power supplies, etc.	$ 1,000
9.	Integration, documentation, check out (6 man months @ $15/hr.)	$15,000
	TOTAL	$48,900

Additional systems of the same design could be built for around $35,000.

Considering the investment in remote station hardware and the advantages of the DRGS, particularly for Alaskan use, the cost of a DRGS is clearly justifiable.

BLOCK DIAGRAM - DRGS

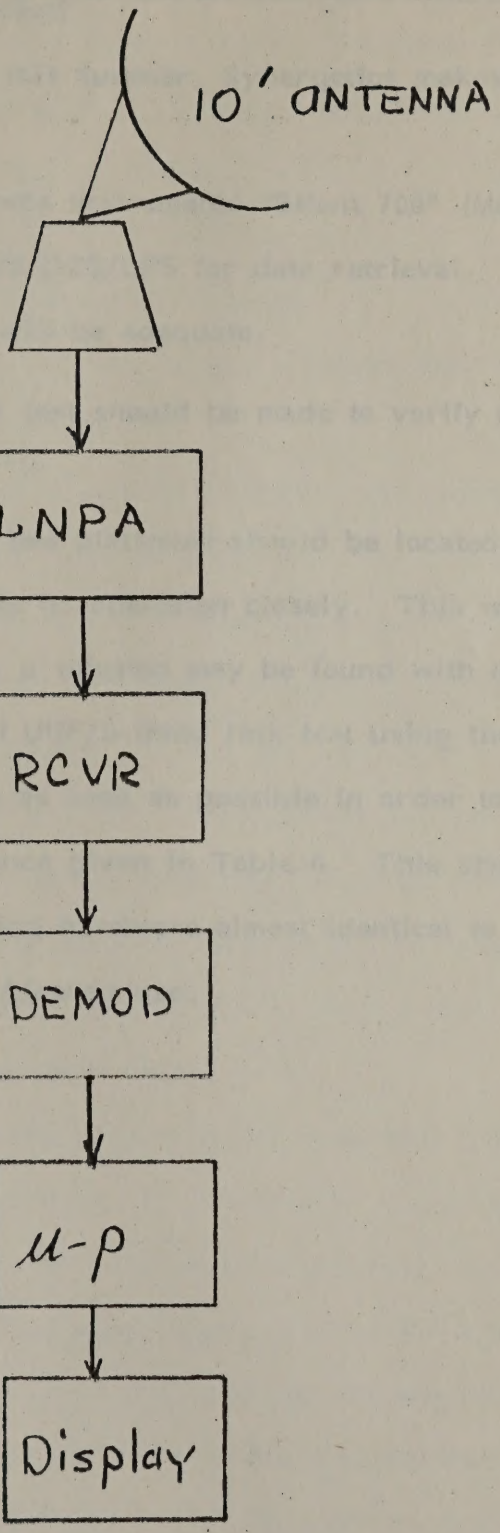

FIGURE 3

VI. RECOMMENDATIONS FOR THE 1977 BLM FIELD PROGRAM (GOES/DCS Demonstration)

For operations this summer, Synergetics makes the following recommendations:

A. Use a Texas Instruments "Silent 700" (Model 742) terminal and the standard DCS/DPS for data retrieval. FTS or commercial switched lines will be adequate.

B. A UHF link test should be made to verify DCPRS performance.

C. One of the two platforms should be located in Anchorage in order to observe its operation closely. This way, if DCPRS problems arise, a solution may be found with minimum difficulty.

D. A combined UHF/S-Band link test using the Canadian DRGS should be made as soon as possible in order to verify the predicted performance given in Table 4. This station has been implemented using hardware almost identical to the design proposed for BLM-Alaskan use.

VII. RECOMMENDATIONS FOR AN OPERATIONAL SYSTEM

A. The use of a DRGS is highly recommended. At this time, Synergetics recommends the following components be used:

1. Prodelin 10' antenna
2. Avantek SD7-XXXXM preamp
3. FG Engineering Receiver
4. Aydin Monitor Systems Demodulator
5. TI 742 terminal

The use of a relatively small (10') antenna for the DRGS has an important "hidden" benefit. Due to the finite movement of the S/C relative to the receiving site, larger antennas require a tracking system to maintain acceptable off-beam-center losses. Since the 10' antenna has a 3 dB HPBW of 4^{o}, the worst-case off-beam-center loss for $^{+}1^{o}$ S/C movement is only 1 dB. Due to higher wind loading (and the resulting movement with the wind) and tighter pointing tolerances, 18' to 30' antennas (as have been used on other DRGS'S) do not offer improved margin in proportion to their higher gains.

The Avantek preamp is recommended because of its superior performance. This amplifier is being used in the S.E.D. system. In addition, the company has an excellent record for meeting these high performance specifications.

The FG Engineering receiver has been designed specifically for GOES/DCS DRGS'S. It is the only known receiver of its kind. The Microdyne Company does manufacture a general purpose receiver for approximately $13,000 which has been used in at least one other DRGS.

The Adin Monitor Systems Demodulator is recommended provided that this company can demonstrate a BER of 10^{-4} @ 11.0 dB S/N. The Bay Technical Associates demodulator may also be acceptable, although their specified performance is suspiciously better than theoretically possible!

B. Timed platforms (rather than the more complex interrogated models) offer higher reliability, and are entirely adequate for synoptic data.

C. Since message lengths are very short compared to the allocated time slots, redundant encoding could be used to guarantee additional margin and overall system reliability, with negligible impact on resources or costs.

D. DCPRS EIRP'S should be carefully adjusted to give the same flux density at the S/C as is measured for platforms at lower latitudes. As much as 2 dB extra EIRP may be required. (This can be accomplished with higher gain antennas if necessary.)

ACKNOWLEDGEMENTS

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Larry Stogner	
Mike Eliot	
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Linda Ward	RCA Alaskom
Al Brandt	ATT - Washington
Cy Settles	NESS CDA Station
Lee Erb	Erbtec Engineering
Connie Boyer	Connie's Secretarial Service

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2. GOES Data Collection System SMS-2 Test Report - Telcom . . . 27 May 1975

3. GOES Data Collection System SMS-1 Test Report - Telcom . . . 10 February 1975

4. User Interface Manual - Prepared for NOAA/NESS by GTE Information Systems. . . 22 October 1976

5. NOAA Technical Report ERL 257-SEL 24 Ionospheric Scintillation Predictions for GOES - Joseph H. Pope . . . January 1973

6. GOES Data Collection System Performance Estimates - P. McManamon - ITS . . . January 1973

7. Minutes of the GOES/DCS Technical Working Group

8. NCAR GAMP Report, CBO-20 Carrier Balloon Link Tests with the SMS-1 Satellite, 4-6 June 1974 - M. L. Olson

APPENDIX

1. DATA SHEET - R. F. SYSTEMS - ANTENNA
2. DATA SHEET - PRODELIN - ANTENNA
3. DATA SHEET- AVANTEK - PREAMP
4. DATA SHEET - FG ENGINEERING - PREAMP
5. DATA SHEET - FG ENGINEERING - RECEIVER
6. DATA SHEET - AYDIN MONITOR SYSTEMS- DEMODULATOR
7. DATA SHEET - BAY TECHNICAL ASSOCIATES - DEMODULATOR

DATA SHEET - R. F. SYSTEMS - ANTENNA

RF ANTENNAS

R F Systems is a Company with ten years experience in the design, development, manufacture and installation of antennas and associated products. These products are primarily for Military, Government, and Commercial Communication and Radar Programs. The Company consists of skilled personnel uniquely qualified to perform to program requirements. It is capable of moving rapidly and steadily to comply with program schedules.

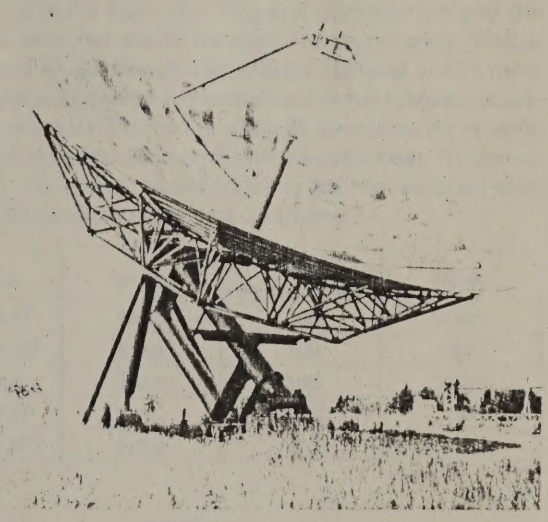
The Company occupies four buildings at its Cohasset, Massachusetts location. These buildings are closely located and integrated into a complete antenna manufacturing and test facility. The buildings include office, laboratory, and manufacturing space. The manufacturing space includes high bay assembly areas with overhead cranes, complete conversion coating and painting facility, fabrication areas, material and tooling storage areas, and packing facilities. Outside storage and packing areas are in the immediate vicinity of the building.

A long range antenna test site is located adjacent to the plant. It includes a completely instrumented building for monitoring tests from indoors. The ranges of up to 4500 feet in length provide excellent characteristics.

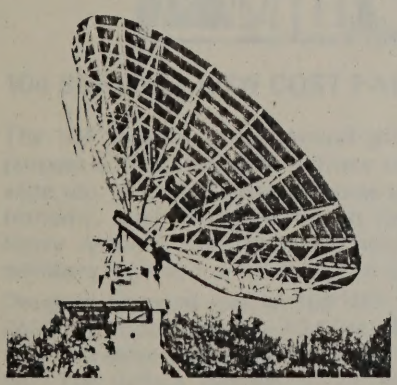
R F Systems has built a wide variety of Antenna Products. Typical examples of the products are shown in these catalogs. Many more products have been designed and manufactured. If you would like more technical information on our products, please contact our Cohasset, Massachusetts office.

SATELLITE TERMINAL ANTENNA SYSTEMS

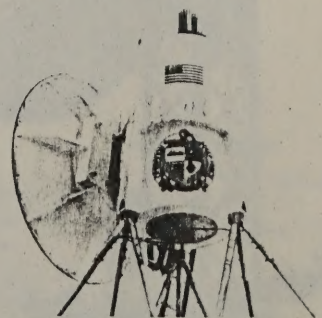
Several completely integrated satellite earth terminals are available from R F Systems. Units are designed for fixed sites and for transportable applications. The photo shown at the right is our 32 foot transportable earth terminal antenna. The basic unit is available from 15 foot to 42 feet in diameter. This unit consists of a high efficiency cassegrain feed system, a heavy duty parabolic reflector, and a polar mount.



The equipment is designed for transmission to and receive from synchronous satellites in the bands 5925-6425 MHz and 3700-4200 MHz. It may be positionable either manually or by motor controls from a remote location. The environmental conditions for normal operation are 30 MPH winds with gusts to 45 MPH, 1" per hour of rain, and ¼" of radial ice. Operating temperature range is from 30°F to +120°F. The equipment will operate with reduced accuracies in winds up to 60 MPH with gusts to 85 MPH, 2" per hour of rain and ½" of radial ice. Survival: 125 MPH gusts with 1" of radial ice. Survival Temperatures: – 60°F to +150°F. The equipment may be utilized at a variety of latitudes from the equator to 73°. Various feed systems are available. The feed systems include flexibility required for operation at linear or circular polarization.



The R F Systems parabolic reflectors may also be supported by the elevation over Azimuth Pedestals. The EL/AZ Unit shown provides for limited motion on both axis by either hand crank or motor driven actuators. Proven position control and position readout equipment is available.



At the right is an unmanned satellite earth terminal antenna located in Antarctica. This unit is used to send information via the Pacific Intelsat Satellite to a California earth station. This antenna utilizes a cassegrain feed system. The aperture is covered by a fiberglass radome to prevent snow accumulation and reduce wind loading. Stations on this type offer the best technique of returning large quantities of data in real time and therefore are a real asset in research programs.

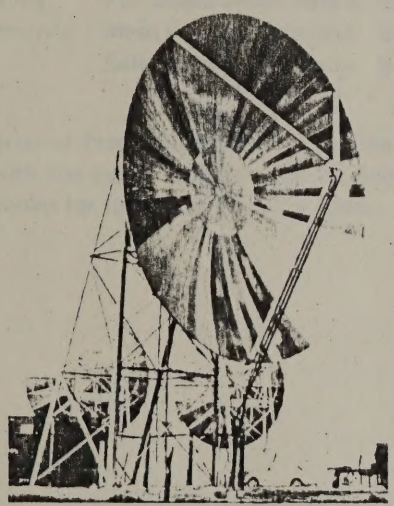
30 FOOTERS

101 SERIES – 150 MPH DESIGN

This high accuracy paraboloid, with solid aluminum, mesh or metallized plastic surface, is designed for wide use in such fields as radio astronomy, tropospheric scatter propagation, tracking, radar, and general purpose use. All–aluminum welded and precision machined construction assures interchangeability of sections and easy assembly.

With an f/d ratio of 0.417, this antenna adapts readily to a wide variety of feed systems. The high accuracy of the solid surface permits use at frequencies above 10,000 Mc. High tensile sheet aluminum surface withstands high wind pressures or the weight of a man without local deformation. The antenna can be mounted on either the top or side of a tower with azimuth and elevation adjustments, on el–az or equatorial pedestals, self–contained trailers, towers, or other types of mounts.

Feed support spars can be attached to the perimeter of the dish or to a circle of supporting points four feet in from the perimeter. Cassegrain feed systems or cantilevered pylon support can be used.



102 SERIES – 120 MPH DESIGN

This antenna is designed for a wide variety of applications and finds considerable use in ground based tropo installations. All aluminum welded construction provides corrosion resistant structure. Design has stiff back truss providing high stiffness and minimizes deflections. Antenna can be assembled rapidly and has minimum number of parts. Utilizes 12 panel construction. With f/d = 0.4 can be used with large variety of feed systems. Disassembles into compact trusses that stack for low cubage. Antenna survives 120 mph with 2" radial Ice (0.5 sp. gr.).

103 SERIES – 150 MPH – RADIAL TRUSS DESIGN

This series of antenna is designed for tracking and telemetry type applications where interface with small to medium bolt circles is required. Design utilizes radial trusses extended from circular hub. Has 24 panel construction and disassembles into flat easily handled structural units. Unit is constructed of aluminum and utilizes stainless or CPI hardware. Basic stiff design is recommended for systems requiring high resonant frequency such as encountered in servo controlled systems. Standard unit has resonant frequency exceeding 10 cycles. Modified units can be supplied with resonant frequencies exceeding 20 cycles.

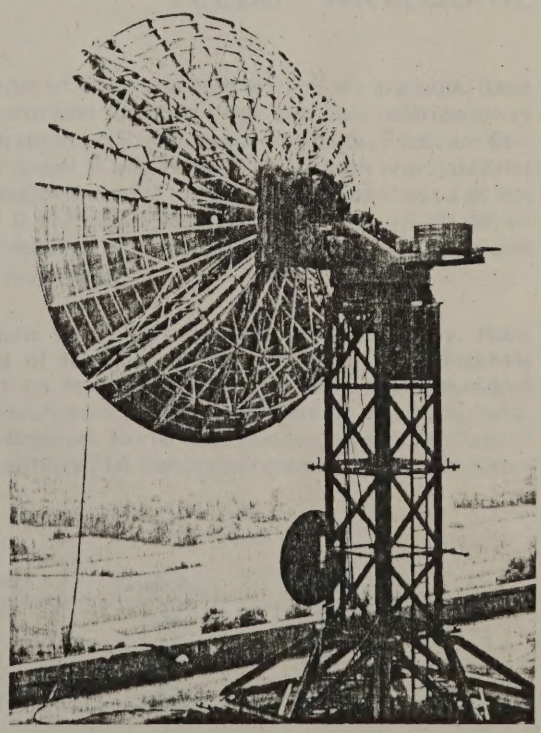
Cat. No.	Surface	Surface Tolerance (RMS)	Weight
103–30 M	Mesh	.200	3300
103–30 MP	Mesh	.100	3300
103–30 S	Solid	.100	3300
103–30 SP	Solid	.035	3300
103–30 SPP	Solid	.020	

104 SERIES – LOW COST PARABOLAS

The 104 Series is an economical antenna designed for use as a general purpose antenna either in military or commercial applications. It finds wide use in CATV Systems, point to point communications, radio astronomy, satellite reception, test range use and has been used in telemetry systems. The structure achieves its rigidity by means of tension members running front and back to a central core.

Designed for wind load of 100 MPH and operation at frequencies up to 2400 MC. Focal length – 12.5 feet. Close tolerance tooling and fabrication guarantee interchangeability of like parts and ease of field assembly. The surface consists of 24 mesh panels, 1" nominal openings, which are field bolted to the supporting radial trusses. The feed support is connected directly to the central hub. The antennas are disassembled for shipment in cartons designed for minimum volume. The antennas are designed for tower mounting.

Cat. No.	Surface	Surface Tolerance (RMS)	Weight	Ship. Weight	Ship. Volume
104–30–M1	1" Steel Mesh	.500	1175	1300	250 cu.ft.
104–30–M2	7/8" Exp. Alum.	.375	1175	1300	250 cu.ft.
104–30–M3	Special	.250	1175	1300	250 cu.ft.

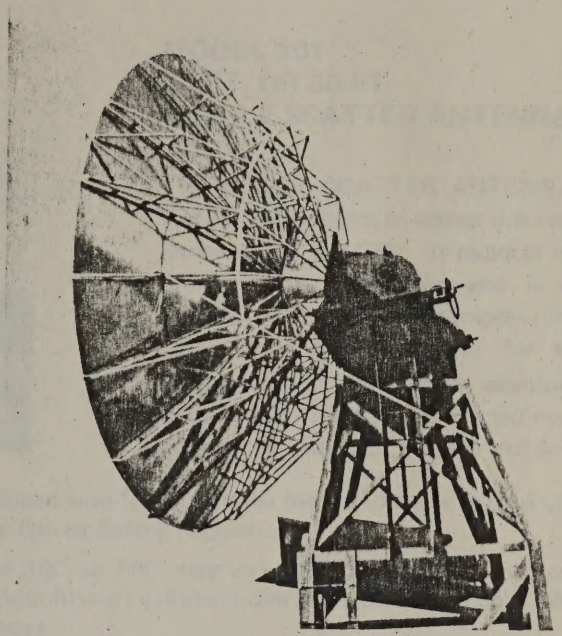


12 to 22 FOOTERS

The 150 Series antennas fill a need for heavy duty precision built antennas in sizes from 12 feet to 22 feet in diameter, and meet requirements for flexibility in antenna design by offering F/D ratios from 0.35 to 0.70 in any size. This heavy duty 150 series is designed for less than 0.500 inch deflection in a 150 MPH wind. Static surface tolerances depend on the model selected.

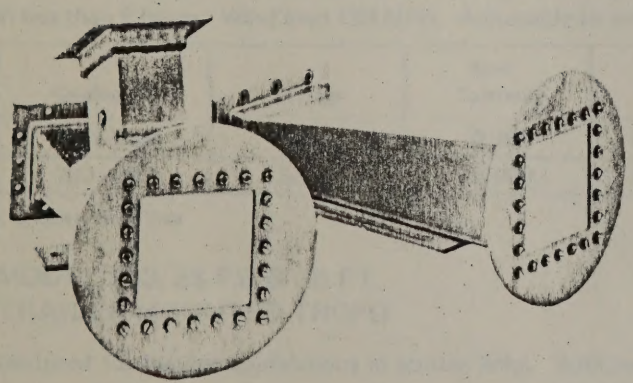
Diameters:	12 feet to 22 feet
F/D Ratio:	0.35 to 0.7 in any size
Surface:	Expanded aluminum mesh or solid aluminum skins
Deflection:	Less than ½ inch under full load
Materials:	High strength aluminum 6061–T6 or 6063–T6
Construction:	Welded and fabricated aluminum with unitized panels and trusses
Vertex opening:	For cassegrainian feed as required
Surface Tolerance:	Mesh surface tolerances: 0.100" RMS Solid surface tolerances: 0.035" RMS

The 160 Series of Precision Reflectors provides even closer tolerances with the use of fiberglass panels. See spec sheet on 160 Parabolas for tolerances to 0.015 RMS.



18 Ft. Reflector

FEEDS - WAVEGUIDE



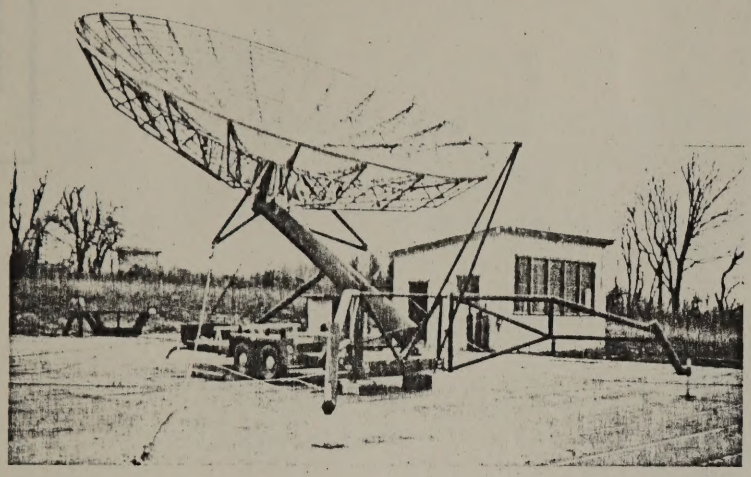
Several types of feeds and feed systems are available. Basic feeds are provided for both single and dual polarization in any of the commonly used frequency bands. Feeds are designed for equal E and H plane beamwidth characteristics and are useable in a wide range of F/D ratios about a design center of 0.417. Edge illumination is 9 to 15 db. When properly installed in parabolic reflectors will provide side lobes less than 20 db.

Construction is of high strength aluminum alloy. Horn window is of low loss silicone fiberglass with thickness dependent on frequency band. All horns are operational under pressurization. Each feed horn is equipped with mounting brackets. Horns include waveguide input. Coaxial line inputs utilize EIA flanges and are provided when specified.

Isolation ranges from 30 – 45 db. Minimum guaranteed 30 db. High Isolation available on special order. VSWR depends on band specified. Typical values for various percentage bandwidth are:

% BW	Single Pol.	Dual Pol.
5	1.05	1.10
10	1.10	1.15
20	1.15	1.25
30	1.20	1.3
40	1.25	1.40

RF MOBILE TROPOS



MODEL 201
28 FT. OR 30 FT.
MOBILE SCATTER ANTENNA

The MOBILE SCATTER ANTENNA is for tactical applications in scatter links and operates up to 5.0 GHz. It requires no preliminary site preparation and is trailer-mounted, ready for air transportation with lifting eyes and tie-downs for securing during transit. It is easily assembled and disassembled and may be erected hydraulically or by means of a winch and A-frame.

The flat bed trailer has tandem wheels and comes completely equipped with fenders, trailer hitch and lights, is equipped with electric brakes; automatic braking system and will meet ICC Motor Carrier Safety Regulations.

Antenna panels are of mesh or solid panel construction. Mesh of 3/8" to 7/8" may be specified. All panel joints are flush with no protuberances. Attachment to supporting trusses is by close fitting jig drilled holes and close fitting bolts. All parts of the antenna are aluminum welded and machined to close tolerances.

The antenna may be easily erected with a crew of 4 men in less than six hours, and after installation can be operated under low wind load conditions without guying. For operation under wind load a guy and anchor kit is provided. The antenna may be adjusted in azimuth and elevation. (Azimuth ±5°, Elevation ±3°) Optional equipment: feed horn access ladder, fitted tarpaulin transit cover, hydraulic erection kit, Mil Spec painting.

MODEL 202, 28 FT. TASK FORCE TROPO

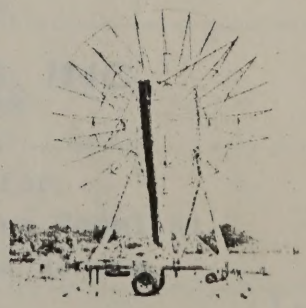
A 28 ft. diameter aluminum reflector, feed support assembly, and feed system in a self-contained steel transit case which serves as the supporting structure. Light weight construction, designed for tactical high gain tropo communications. Complete mobility – air or ground – using standard military or commercial vehicles, readily erected in any location without the use of special tools or equipment. Feed system designed for optimum performance in all tropo bands. Useable as a permanent fixed installation. High efficiency feed system available as option. Focal length 12.5 ft. Erection with crew of 4 men in less than 6 hours. Wind load 100 MPH. Adjustable to within ±5°.

Catalog No.	Surface	Surf. Tolerance	Total Weight	Package Length	Package Width	Package Height	C/L Height
202–28M	Mesh *	0.200	6500 lbs.	142"	81"	83"	18'
202–28S	Solid	0.100	6500 lbs.	142"	81"	83"	18'

* Specify Mesh Size

MODEL 203, 28 FT. & 30 FT.
TRAILER MOUNTED TROPO

Designed for tactical applications in scatter links. Built to meet military specifications, and operate effectively up to 5.0 MHz. May be used at semi-permanent sites or fixed installations. No preliminary preparation of the operating site is necessary. Rapid erection and disassembly. Ground anchor kit is supplied. Assembled and erected in 24 man-hours. Power or manually operated winch may be used to erect the antenna. Focal length 12.5 ft.



REV

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REVISIONS

SYM	ECN	DESCRIPTION	DATE	APPROVAL
	B		5/24/76	

		REV	B	B																				
NEXT ASSY	USED ON	SHEET	2	3	4	5	6	7	8															
APPLICATION		REVISION STATUS OF SHEETS																						

WRITTEN BY: E K Smith	DATE: 5/24/76	R F SYSTEMS, INC. COHASSET, MASS.
CHECKED BY		
ENG. APPROVAL		TITLE: Specification for 30 Ft. SMS/GOES Satellite Terminal, Model 804-2 Receive System
ENG. APPROVAL		

CAUTION

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CODE IDENT NO.	SIZE		REV
24854	A	812538	B
		SHEET 1 OF 3	

Specification for

30 Ft. SMS/GOES Satellite Terminal

Model 804-2 Receive System

1.0 GENERAL

Description: The Model 804-2 is a satellite terminal antenna utilizing a 30-foot diameter reflector mounted on an El/Az mount. It is equipped with a C.P. feed to provide reception of signals in the band 1669.6 MHz to 1694.9 MHz.

2.0 ELECTRICAL SPECIFICATIONS

Frequency Band:	1669.6 - 1694.9 MHz
Polarization:	Right hand circular
Optional Polarization:	Rotatable linear
VSWR:	1.25
Half Power Beamwidth:	1.4^{o} nominal
First Side Lobes:	20 dB
Other Lobes:	Attenuate gradually
Gain:	41 dbi minimum
Input Impedance:	50 Ohms
Input Connector:	Type N Female

3.0 MECHANICAL SPECIFICATIONS

Survival wind load:	100 MPH
Operational wind load:	45 MPH
Materials:	Aluminum - 6061T6
	Aluminum - 6063T5
	Mesh - 5/8 aluminum
	Steel - HR structural steel zinc rich paint
	Hardware - interplate

4.0 OPERATIONAL REQUIREMENTS

Motion:	Elevation - 0^{o}-90^{o} total range.
	$\pm 10^{o}$ continuous adjustment.
	Azimuth - $\pm 15^{o}$ continuous adjustment.
Operational:	45 MPH
Stow wind:	60 MPH
Survival at stow:	80 MPH
Standard drives:	Hand operated and clamping mechanism.
Optional drive:	Linear actuators with motor drives and controls.

5.0 The supplier shall submit measured antenna patterns, measured gain figures, and measured VSWR and submit these data at the time the antenna is shipped.

DATA SHEET - PRODELIN - ANTENNA

The Company

THE PRODUCTS

Within this catalog is presented a very comprehensive product line of computer engineered quality antennas and R F coaxial cable and waveguide systems with their associated matching components.

All products are designed to achieve maximum performance under "field conditions." Our many years of experience with actual installations enable us to provide reliable end products that are installed with minimum effort.

With plants located across the country, Prodelin is able to provide prompt service nationwide.

Prodelin can assist by providing field engineering and installation of complete antenna, coaxial cable and waveguide systems.

Prodelin, Inc. now enters its 32nd year of service to the communication industry. The original Prodelin objective was to design and manufacture the finest antenna and transmission line systems to satisfy the most demanding propagation requirements in all areas of the radio art.

More than twenty five years ago starting with the very first U.S. microwave antenna and transmission line system for Keystone Pipeline in Pennsylvania, Prodelin recognized and responded to the requirements for industrial and common carrier microwave systems, and participated in the establishment of system criteria and standards.

In keeping with Prodelin's objective of continued advancement in antenna concepts, capabilities were expanded in 1969 by acquiring a firm specializing in the production of Fiberglass Reinforced Precision Antennas. This catalog offers a full complement of antennas covering frequencies from 400 MHz to 15.2 GHz.

In 1974 Prodelin's capabilities were expanded still further by acquiring a plant exclusively devoted to manufacturing premium and super-premium copper corrugated coaxial cables, and copper corrugated elliptical waveguide.

Prodelin also provides a field installation "turnkey" service, providing path survey engineering, installation of antennas, transmission lines, antenna orientation, sweep for recording and return loss and will guarantee antenna system performance to customer specifications.

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Fiberglass parabolic antennas

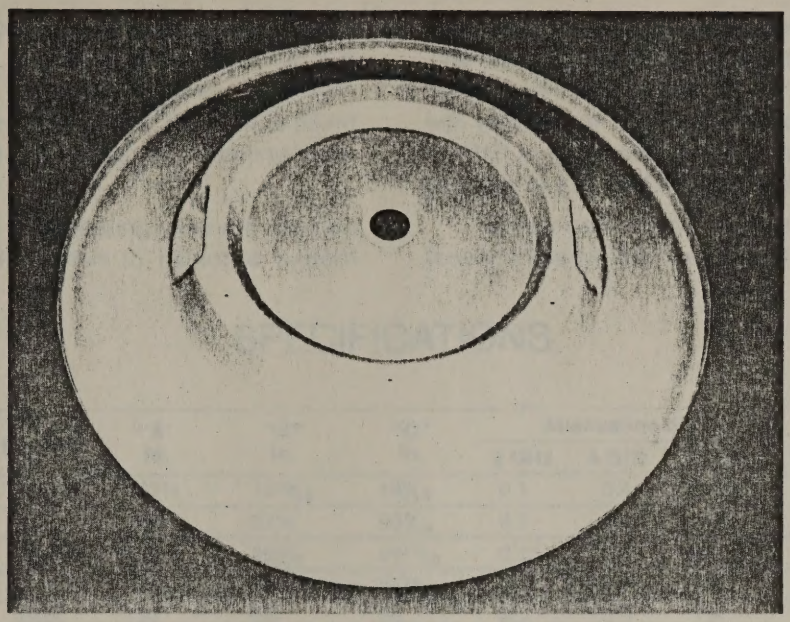
1.7-2.3 GHz

Frequency GHz	Dia. Ft. (Meters)	Cat. No. Standard	Cat. No. Low VSWR	Gain dBi Midband	HPBW Degrees E plane	F/B dB	Maximum VSWR Standard	Maximum VSWR Low VSWR
Standard Antennas — *Plane* Polarized								
1.7 to 2.1	4 (1.22)	52-740	——	25.1	9.50	30	1.3	1.15
	6 (1.83)	53-740	53-741	28.7	6.30	36	1.3	1.10
	8 (2.44)	54-740	54-741	31.1	4.70	39	1.2	1.06
	10 (3.0)	55-740	55-741	33.0	3.78	44	1.2	1.06
	12 (3.66)	56-740	56-741	34.7	3.08	47	1.2	1.06
	15 (4.57)	57-740	57-741	36.5	2.51	49	1.2	1.06
1.9 to 2.3	4 (1.22)	62-740	——	25.9	8.60	30	1.3	1.15
	6 (1.83)	63-740	63-741	29.4	5.70	36	1.3	1.10
	8 (2.44)	64-740	64-741	31.9	4.30	39	1.2	1.06
	10 (3.0)	65-740	65-741	33.8	3.41	44	1.2	1.06
	12 (3.66)	66-740	66-741	35.4	2.85	47	1.2	1.06
	15 (4.57)	67-740	67-741	37.4	2.35	49	1.2	1.06
1.7 to 1.85	4 (1.22)	72-740	72-741	24.1	10.0	30	1.3	1.15
	6 (1.83)	73-740	73-741	27.8	6.70	36	1.3	1.10
	8 (2.44)	74-740	74-741	30.4	5.0	39	1.2	1.06
	10 (3.0)	75-740	75-741	32.3	4.0	44	1.2	1.06
	12 (3.66)	76-740	76-741	34.0	3.35	47	1.2	1.06
	15 (4.57)	77-740	77-741	35.9	2.68	49	1.2	1.06
1.85 to 1.99	4 (1.22)	82-740	82-741	24.9	9.50	30	1.3	1.15
	6 (1.83)	83-740	83-741	28.8	6.30	36	1.3	1.10
	8 (2.44)	84-740	84-741	31.2	4.70	39	1.2	1.06
	10 (3.0)	85-740	85-741	33.2	3.78	44	1.2	1.06
	12 (3.66)	86-740	86-741	34.8	3.08	47	1.2	1.06
	15 (4.57)	87-740	87-741	36.8	2.51	49	1.2	1.06
1.99 to 2.11	4 (1.22)	92-740	92-741	25.6	9.0	30	1.3	1.15
	6 (1.83)	93-740	93-741	29.3	6.0	36	1.3	1.10
	8 (2.44)	94-740	94-741	31.8	4.50	39	1.2	1.06
	10 (3.0)	95-740	95-741	33.6	3.60	44	1.2	1.06
	12 (3.66)	96-740	96-741	35.2	3.0	47	1.2	1.06
	15 (4.57)	97-740	97-741	37.1	2.40	49	1.2	1.06
2.11 to 2.3	4 (1.22)	102-740	102-741	26.3	8.30	30	1.3	1.15
	6 (1.83)	103-740	103-741	29.8	5.50	36	1.3	1.10
	8 (2.44)	104-740	104-741	32.4	4.10	39	1.2	1.06
	10 (3.0)	105-740	105-741	34.3	3.30	44	1.2	1.06
	12 (3.66)	106-740	106-741	35.8	2.71	47	1.2	1.06
	15 (4.57)	107-740	107-741	37.8	2.19	49	1.2	1.06
Standard Antennas — *Dual* Polarized								
1.7 to 1.85	6 (1.83)	73-742	73-743	27.5	6.70	36	1.4	1.08
	8 (2.44)	74-742	74-743	30.0	5.0	39	1.3	1.08
	10 (3.0)	75-742	75-743	31.9	4.0	44	1.3	1.08
	12 (3.66)	76-742	76-743	33.6	3.35	45	1.3	1.08
	15 (4.57)	77-742	77-743	35.5	2.68	47	1.3	1.08
1.85 to 1.99	6 (1.83)	83-742	83-743	28.2	6.30	36	1.4	1.08
	8 (2.44)	84-742	84-743	30.7	4.70	39	1.3	1.08
	10 (3.0)	85-742	85-743	32.6	3.78	44	1.3	1.08
	12 (3.66)	86-742	86-743	34.2	3.08	45	1.3	1.08
	15 (4.57)	87-742	87-743	36.2	2.51	47	1.3	1.08
1.99 to 2.11	6 (1.83)	93-742		28.9	6.0	36	1.25	
	8 (2.44)	94-742		31.4	4.50	39	1.25	
	10 (3.0)	95-742		33.3	3.60	44	1.2	
	12 (3.66)	96-742		34.9	3.0	45	1.2	
	15 (4.57)	97-742		36.8	2.40	47	1.2	
2.11 to 2.20	6 (1.83)	103-742		29.3	5.48	36	1.25	
	8 (2.44)	104-742		31.9	4.19	39	1.25	
	10 (3.0)	105-742		33.8	3.28	44	1.25	
	12 (3.66)	106-742		35.3	2.80	45	1.20	
	15 (4.57)	107-742		37.2	2.20	47	1.20	
High Performance Antennas — *Plane* Polarized								
1.7 to 2.1	8 (2.44)		54-700	31.1	4.70	56		1.06
	10 (3.0)		55-700	33.0	3.78	58		1.06
	12 (3.66)		56-700	34.7	3.08	60		1.06
	15 (4.57)		57-700	36.5	2.51	62		1.06
1.9 to 2.3	8 (2.44)		64-700	31.9	4.30	56		1.06
	10 (3.0)		65-700	33.8	3.41	58		1.06
	12 (3.66)		66-700	35.4	2.85	60		1.06
	15 (4.57)		67-700	37.4	2.35	62		1.06

Antenna Mounts, see pages 24, 25, 26.

Fiberglass parabolic reflectors

STANDARD
8′ (2.44m)—10′ (3.0m)

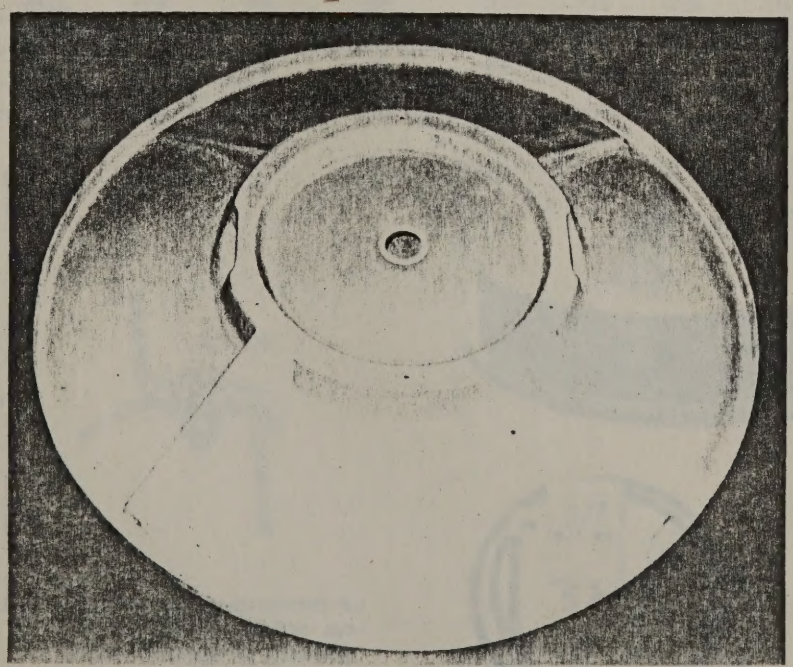


8 Ft. (2.44m) Rear View
Part No. PA179-61-1

Rear views of 8 Ft. (2.44m) and 10 Ft. (3.0m) MASAR reflectors illustrate the back reinforcing and mounting ring.

Nut plates are bonded in 3 places on the inside of the ring and on each side through the center line. This design permits the use of either the 3 point pipe mount Cat. No. 42-140 or the 4 point pipe mount Cat. No. 52-140.

The design of the reinforcing ring provides ruggedness and stability and assures the accuracy of the reflector in all environmental conditions.



10 Ft. (3.0m) Rear View
Part No. PA179-66-1

Fiberglass RADOMES

Prodelin fiberglass radomes are molded to a smooth surface to shed snow, ice and other material. The 2 ft (0.61 m) through 8 ft (2.44 m) sizes are one piece construction. The 10 ft (3 m) size is two piece. The 12 ft (3.66 m) and 15 ft (4.57 m) sizes are four piece. All mounting hardware is supplied.

Heated radomes have the heating element molded into the radome in a configuration to minimize pattern distortion. There is no need to take polarization into account. The heating element is controlled by a thermostat. When the temperature falls to + 35°F (+ 2°C) heating is turned on and will remain on until the temperature falls below + 25°F (- 4°C) at which time power is off. The 2 ft, 4 ft and 6 ft sizes operate at 120 VAC. All other sizes operate at 240 VAC.

Heavy duty randomes are available on special order to withstand wind forces of 200 mph.

SPECIFICATIONS

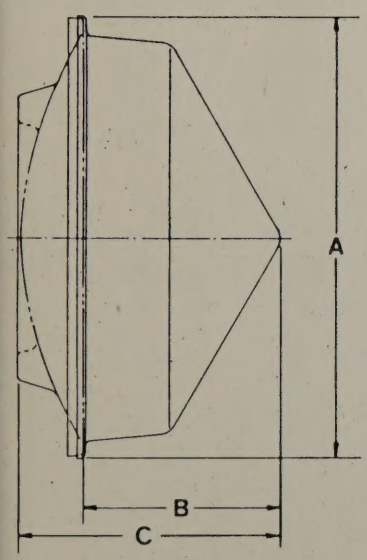
Unheated Radomes

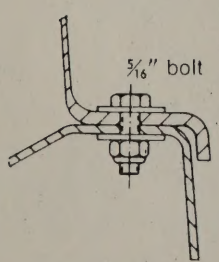
Cat. No.	Dia. Ft.	(Meters)	"A" In.	"B" In.	"C" In.	Attenuation dB 2 GHz	6 GHz	12 GHz	VSWR All Freq.	Wind Rating MPH	(km/hr.)
61-140	2	(0.61)	27½	14 15/16	18 9/16	0.1	0.4	1.0	1.04	125	(200)
62-140	4	(1.22)	52	23¼	30 3/16	0.1	0.4	1.25	1.04	125	(200)
63-140	6	(1.83)	75 5/8	29 3/32	39 15/16	0.15	0.5	1.4	1.03	125	(200)
64-140	8	(2.44)	99 5/8	36⅛	51⅛	0.2	0.6	1.6	1.02	125	(200)
65-140	10	(3.0)	124	38	56	0.2	0.9	1.8	1.02	125	(200)
66-140	12	(3.66)	149	54	78	0.3	1.0	1.85	1.02	125	(200)
67-140	15	(4.57)	185	58	95	0.5	1.1	1.9	1.02	125	(200)

Heated Radomes

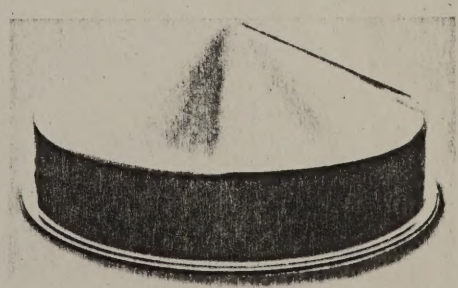
Cat. No. 6 to 12 GHz	Cat. No. 2 GHz	Dia. Ft.	(Meters)	"A" In.	"B" In.	"C" In.	Attenuation dB 2 GHz	6 GHz	12 GHz	Power Watts	VSWR All Freq.	Wind Rating MPH	(km/hr.)
71-140	171-140	2	(0.61)	27½	14 15/16	18 9/16	0.2	0.9	1.2	140	1.04	150	(240)
72-140	172-140	4	(1.22)	52	23¼	30 3/16	0.2	0.9	1.45	650	1.04	150	(240)
73-140	173-140	6	(1.83)	75 5/8	29 3/32	39 15/16	0.3	1.0	1.6	1300	1.03	150	(240)
74-140	174-140	8	(2.44)	99 5/8	36⅛	51⅛	0.3	1.1	1.8	2500	1.02	125	(200)
75-140	175-140	10	(3.0)	124	38	56	0.4	1.3	2.0	3100	1.02	125	(200)
76-140	176-140	12	(3.66)	149	54	78	0.6	1.4	2.05	4500	1.02	125	(200)
77-140	177-140	15	(4.57)	185	58	95	0.9	1.5	2.1	8000	1.02	125	(200)

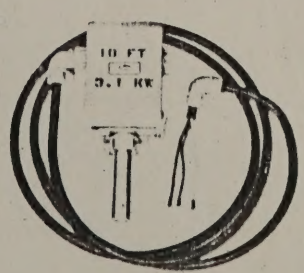
NOTE: Conversion: Inches to centimeters multiply by 2.54. Inches to millimeters multiply by 25.4.



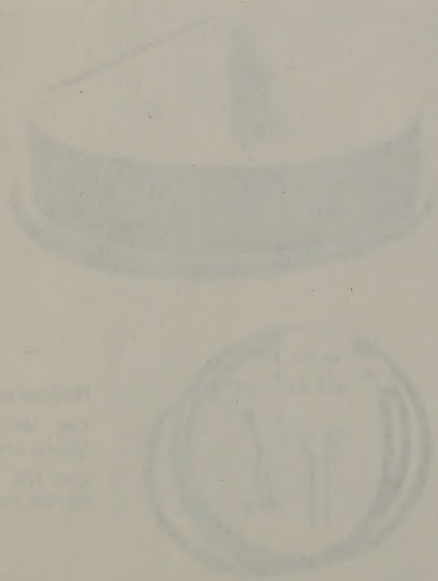


Bolting is recommended for a positive trouble-free system. Hardware is supplied.





Replacement thermostats.
Cat. No. 127-150. 240 VAC 50/60 Hz.
Cat. No. 126-150. 120 VAC, 50/60 Hz.



DATA SHEET - AVANTEK - PREAMP

April 15, 1977

Avantek

Mr. Mike Exner
Synergetic
P.O. Box E
Boulder, CO 80306

Dear Mr. Exner:

Per your telephone request of April 14, 1977, Avantek is pleased to provide the attached Quotation #17035WB for low noise antenna preamps cover the 1695 MHz frequency range. This amplifier is a realigned version of a Marisat communication amplifier and utilizes Gallium Arsenide FET (GaAs FET) transistors to provide the required noise figure of 2 dB max. The gain of this amplifier is 30 dB min.

Since this is basically a standard Avantek AM-1662 amplifier, it offers the same proven reliability as other amplifiers of its type. As with all Avantek products, tightly controlled processes are used to manufacture the RF transistors. This in-house capability assures proven reliability as well as product performance and uniformity.

I trust this information satisfies your current requirements. Should you have any questions concerning this quotation or any of Avantek's products or their applications, please contact me directly at 408/249-0700 or through our representative in your area, Mr. Les Tucker of The Thorson Company, Denver, at 303/759-0809.

Best regards,

James Lindsay for Wayne Briggs

Wayne E. Briggs
Market Manager
Instrumentation/Communications Components

/jkd

Enclosures: Quotation #17035WB
Microwave Short Form Catalog
Marisat AM-1662 Data Sheet

cc: Les Tucker, Thorson, Denver

Avantek

Avantek

3175 Bowers Avenue, Santa Clara, Calif. 95051
Telephone (408) 249-0700
TWX: 910-339-9274

QUOTATION

NUMBER 17035WB
PLEASE REFER TO THIS NUMBER WHEN ORDERING

PLEASE ADDRESS INQUIRIES AND REPLIES TO

Synergetic
P.O. Box E
Boulder, CO 80306

Attention: Mr. Mike Exner

The Thorson Company
5290 Yale Circle
Denver, CO 80222

Attention: Mr. Les Tucker

TELEPHONE NO. 303/759-0809

YOUR REFERENCE Telephone Request of 4/14/77

E DATE	QUOTATION DATE	QUOTE FIRM FOR	TERMS	F.O.B. POINT
	4/15/77	30 DAYS	1/2%-15, NET 30 DAYS	Santa Clara, CA

QUANTITY	DESCRIPTION	APPROX* SHIP SCH.	UNIT PRICE	TOTAL
1-2	Avantek SD7-XXXXM (AM-1662) Amplifier with the following specifications:	30-45 days ARO	$875.00	
	Frequency: 1695 MHz with a minimum bandwidth ±1 MHz			
	Noise Figure: ≤2 dB max			
	Gain: 30 dB min			
	Power Output: +10 dBm			
	Gain Flatness: ±0.25 dB			
	Intercept Point: +20 dBm typical			
	VSWR: 1.25:1 In/1.5:1 Out			
	Input Power +15V @≈50 mA			

*SUBJECT TO PRIOR SALE.

AVANTEK, INC.

BY James Lindaman for Wayne Briggs
Wayne E. Briggs, Market Manager
Instrumentation/Communications Components/jkd

AVANTEK, INC. IS A SMALL BUSINESS CONCERN PER GOVERNMENT REQUIREMENTS.

THIS QUOTATION IS SUBJECT TO THE TERMS AND CONDITIONS ON THE REVERSE SIDE

PRINTED IN U.S.A.

CUSTOMER ORIGINAL

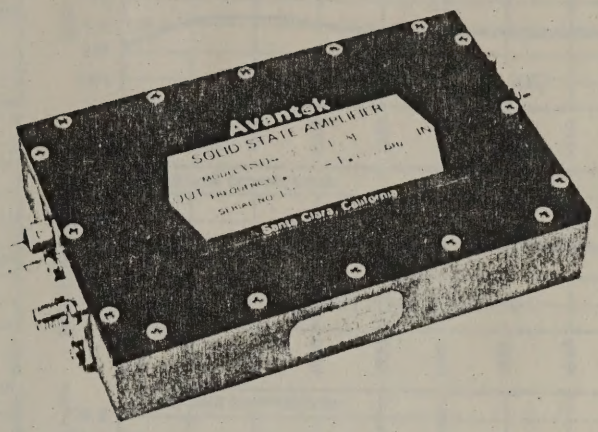
Avantek

DATA SHEET

AM-1661, AM-1662
Satellite Terminal Preamps
1535-1660 MHz

FEATURES

- 30 and 50 dB Gain Options
- Ultra-Flat Gain Response and Minimum Gain Slope
- Ultra-Low Noise Figure
- Wide Dynamic Range
- 100,000 Hour MTBF (Calculated)
- Withstands Salt Spray, Humidity, Dust and Vibration
- No Detectable Microphonics
- Optional Regulator For +18 to +26 VDC Operation



DESCRIPTION

The AM-1661 and AM-1662 are low noise, all solid-state preamplifiers specifically designed for receiver front-end use in satellite terminals. The frequency range covers MARISAT, AEROSAT and ground positioning dowlink bands. Extremely flat gain response, minimum gain slope and group delay assures undistorted amplification of voice and digital signals.

Avantek's unique matching circuitry and all gold-metallized arsenic-emitter silicon bipolar transistors provide high gain, ultra-low noise figure, low VSWR and wide dynamic range. Rugged, proven construction technology assures long life and reliable operation under severe environmental conditions and prevents microphonic generation with vibration.

The hermetically sealed package permits antenna mounting and will withstand 100% humidity, salt spray, corrosion from fumes and stack gases, fungus growth and windblown dust.

GUARANTEED SPECIFICATIONS (-40°C to +65°C)

Model	Frequency Response (MHz) (1) Minimum	Gain (dB) Minimum	Flatness (±dB) Maximum	Slope (dB/MHz) Maximum	Noise Figure (dB) Maximum	VSWR (50 ohms) Maximum In	VSWR (50 ohms) Maximum Out	Power Output For 1 dB Gain Compression (dBm) Minimum	Typical Intercept Point for IM Products (dBm) Minimum	Input Power (at 1% regulation) VDC(2)	Input Power (at 1% regulation) mA typical
AM-1661	1535-1660	50	0.25	0.1	2.5	1.25	1.5	+12	+25	+15	80
AM-1662	1535-1660	30	0.25	0.1	2.5	1.25	1.5	+10	+20	+15	50

(1.) A version, AM-1660, is available with 4-pole filter. Factory tunable to cover any selected 10 MHz band in the frequency range. Versions also available to cover 300 MHz portions of the 1.2-2.5 GHz range. Contact factory.

(2.) With optional integral regulator +18 to +26 VDC. current remains the same.

Dimensions: AM-1661, AM-1662, 4.2 in x 2.7 in x 0.72 in, weight 11.64 oz
106.8 mm x 68.58 mm x 18.29 mm, weight 330 g

Connectors: Type N or SMA

Spurious Outputs: None

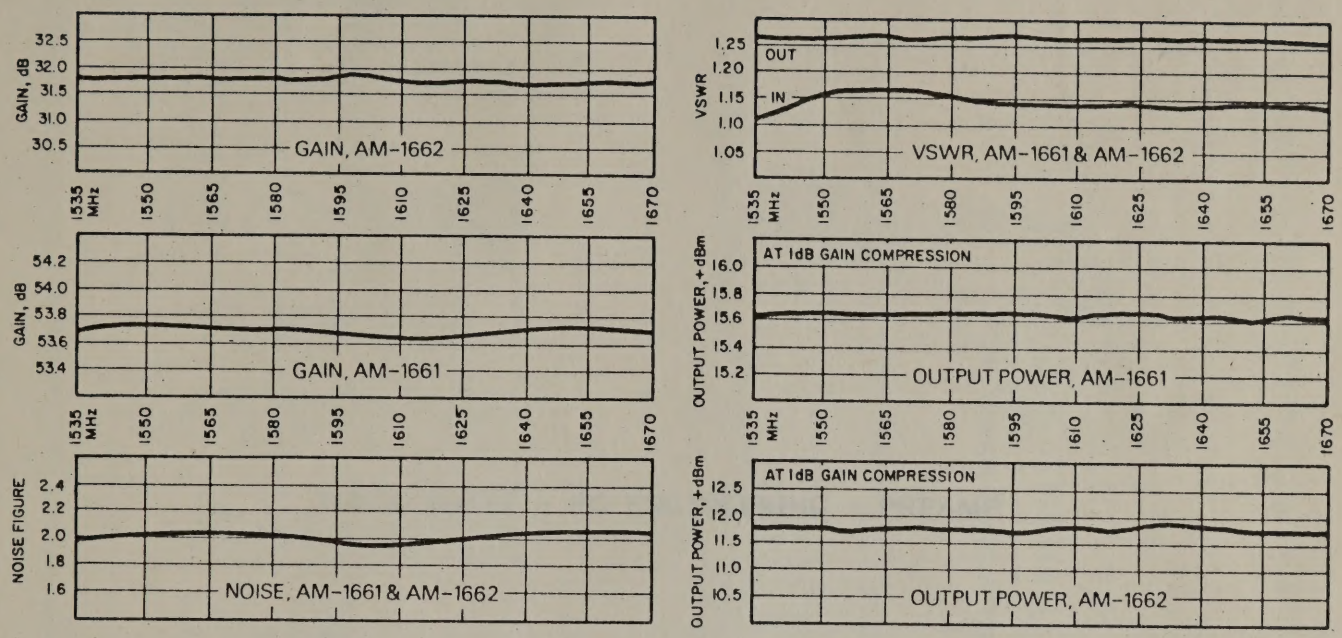
Humidity: 100% including frost, water or salt spray

Corrosion: Resistant to corrosion from salt air, salt spray, salt residues, stack gases, stack gas residue and wind blown dust

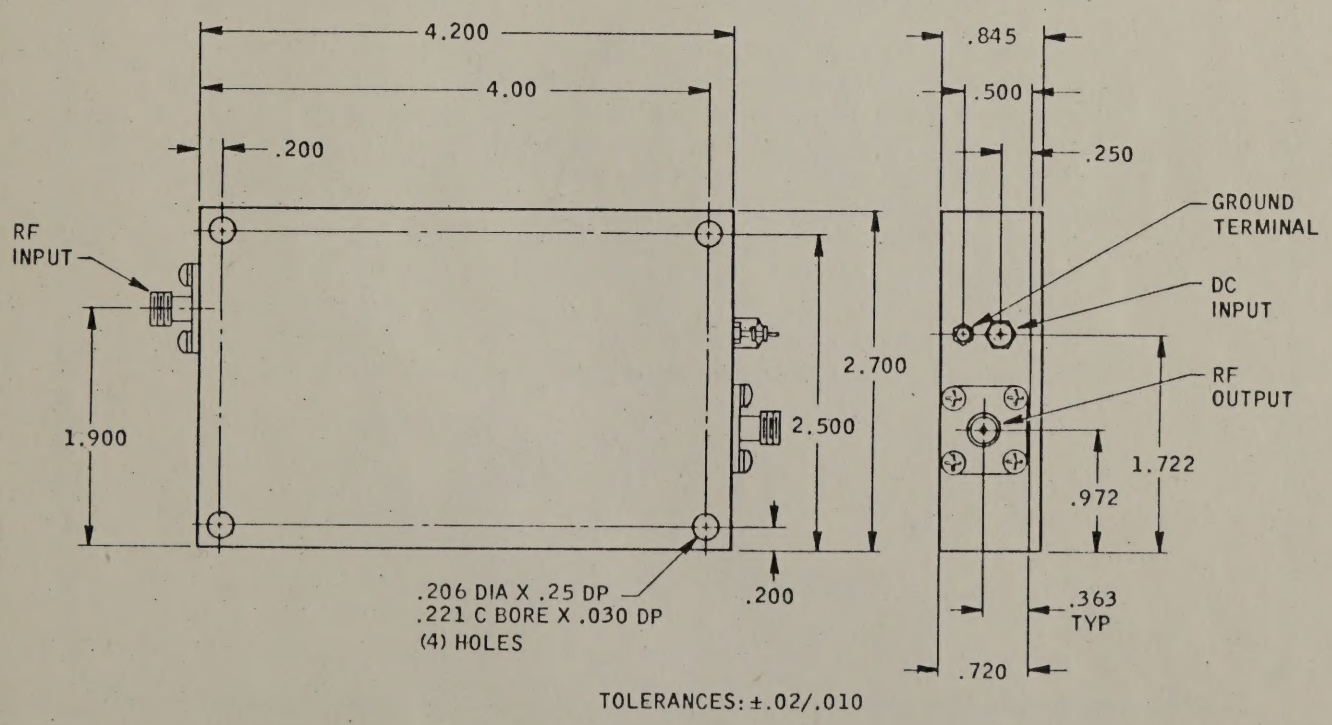
Fungus: Impervious to effects of fungus as occurs in tropical marine climates

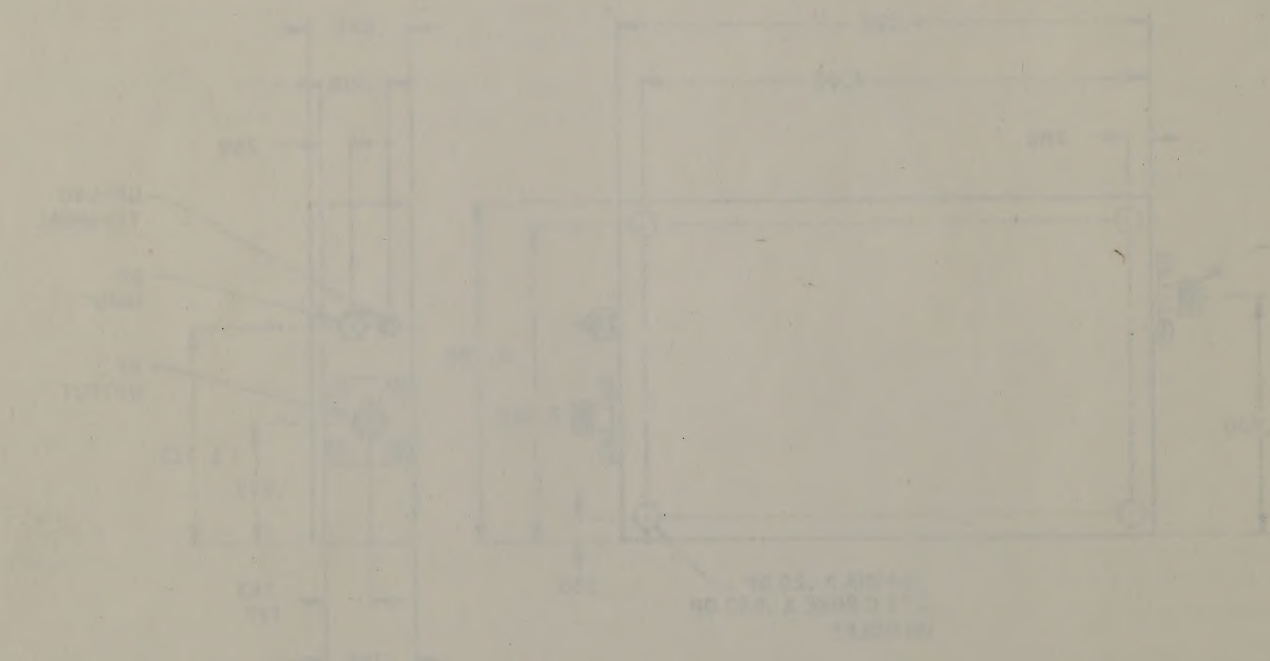
Avantek, Inc., Advanced solid-state products • 3175 Bowers Avenue, Santa Clara, California 95051 • Phone (408) 249-0700 • TWX 910-339-9274 • Cable: Avantek

TYPICAL PERFORMANCE—AM-1661, AM-1662



OUTLINE DRAWING



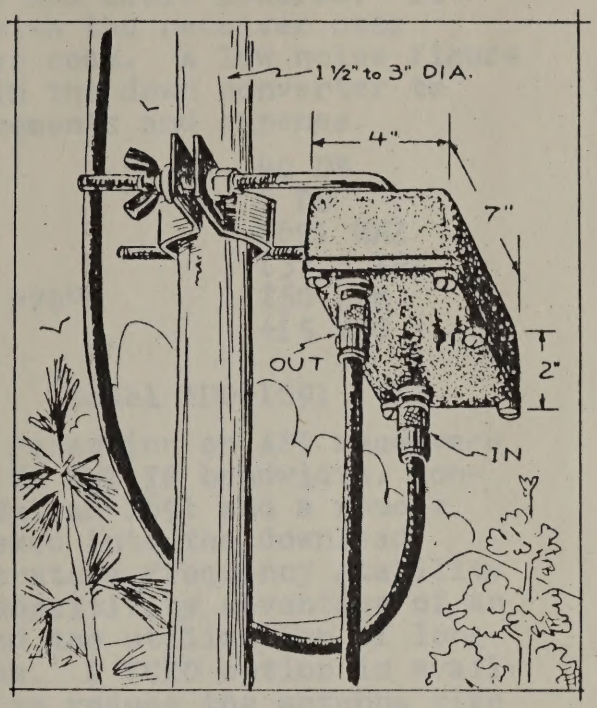


DATA SHEET - FG ENGINEERING - PREAMP

1691 MHZ WEFAX

◎ Receivers
⊙ Down Converters
⊙ Antenna Preamps

ENGINEERING



WEFAX RECEIVER Model AR-1691

Consists of an integrated antenna mounted MW down converter and a rack mounted VHF receiver. The down converter is in a rugged weatherproof housing with adjustable mounting brackets. It is lightening protected and cable powered from the receiver. They can be interconnected with long runs of inexpensive coax. The down converter includes a low noise figure MW preamp and the VHF receiver employs AFC to minimize bandwidth. Thus sensitivity is maximized and antenna requirements and expense are minimized.

Frequency	1691 MHZ
Noise Figure	3 DB
IF Bandwidth	26 KHZ
Threshold	0.5 uV
Video Bandwidth	5 KHZ
Video output level, 600 ohms	2.5 V p-p
Power supply	115/230 VAC

BLACK CANYON STAGE • BOX 506 • PHOENIX, AZ. 85020 • 602/465-7735

WEFAX

Receivers

Down Converters

Antenna Preamps

WEFAX DOWN CONVERTER — Model AD-1691

Enables 1691 MHZ WEFAX reception on APT receivers with AFC. Antenna mounted rugged weatherproof housing with adjustable mounting brackets. It is lightening protected and cable powered. It may be interconnected with the receiver over long runs of inexpensive coax. A low noise figure MW preamp is included in the down converter to minimize antenna requirements and expense.

Conversion Gain	40 DB
Noise Figure	3 DB
Input Frequency	1691 MHZ
Output Frequency	137.5 MHZ
Stability, -20 to +70°C	±50 ppm
Supply	+15 VDC

WEFAX DOWN CONVERTER — Model ADO-1691

Enables 1691 MHZ WEFAX reception on APT receivers without AFC and having 70 KHZ IF bandwidth. Consists of a modified Model AD-1691 and a remote indoor oscillator diplexed into the downlead. This gives a room temperature frequency stability while maintaining the sensitivity advantage of an antenna mounted unit and the utilization of long runs of inexpensive coax. A VCXO option is available for phase locking to reduce the antenna size requirement in half. An AC powering option is also available.

ANTENNA PREAMP — Model AP-1691

Improves sensitivity and overcomes downlead loss. This is the RF amp portion of the WEFAX DOWN CONVERTER with the same housing, mounting brackets, cable powering, and lightening protection.

Frequency	1691 MHZ
Gain	25 DB
Noise Figure	2.5 DB
Supply	+15 VDC

ANTENNA PREAMP — Model AP-137.5

This is the IF amp portion of the WEFAX DOWN CONVERTER with the same features as above except CF=137.5 MHZ and NF=2 DB.

ANTENNA FILTER PREAMP — Model AFP-137.5

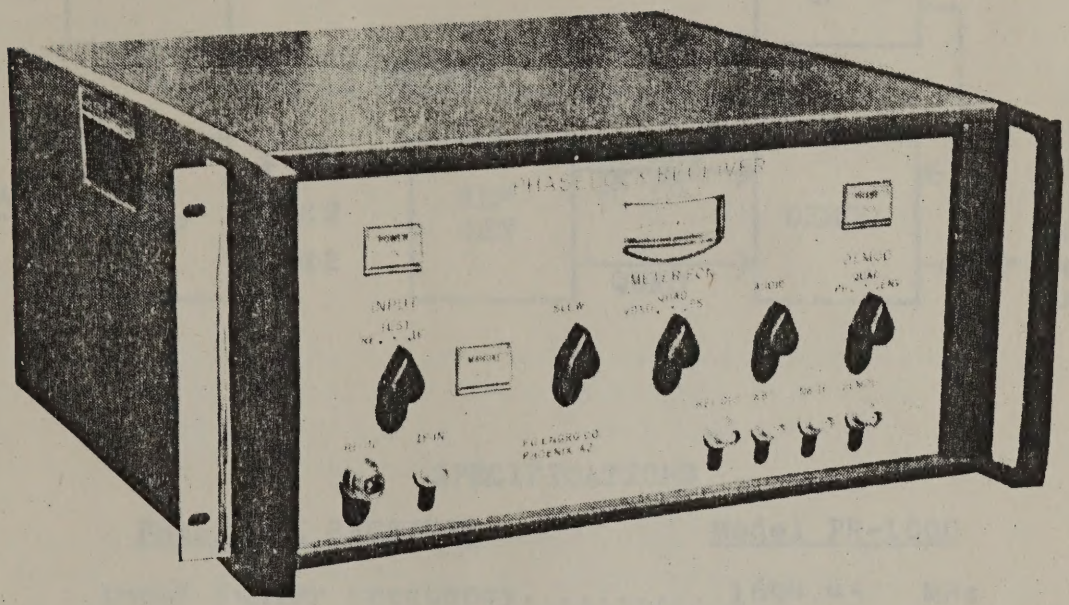
This is the above IF amp with a 1% cavity filter ahead of it to reject adjacent channel interference.

FOR FURTHER INFORMATION ON THESE AND MANY OTHER ITEMS
CALL THE FG ENGINEERING CO. 602/465-7735

DATA SHEET - FG ENGINEERING - RECEIVER

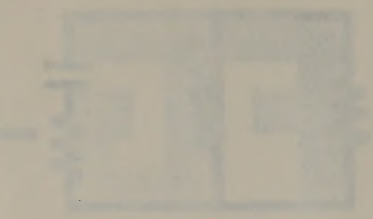
FG ENGINEERING CO.

SMS/GOES DCP CHANNELS PHASELOCK RECEIVERS

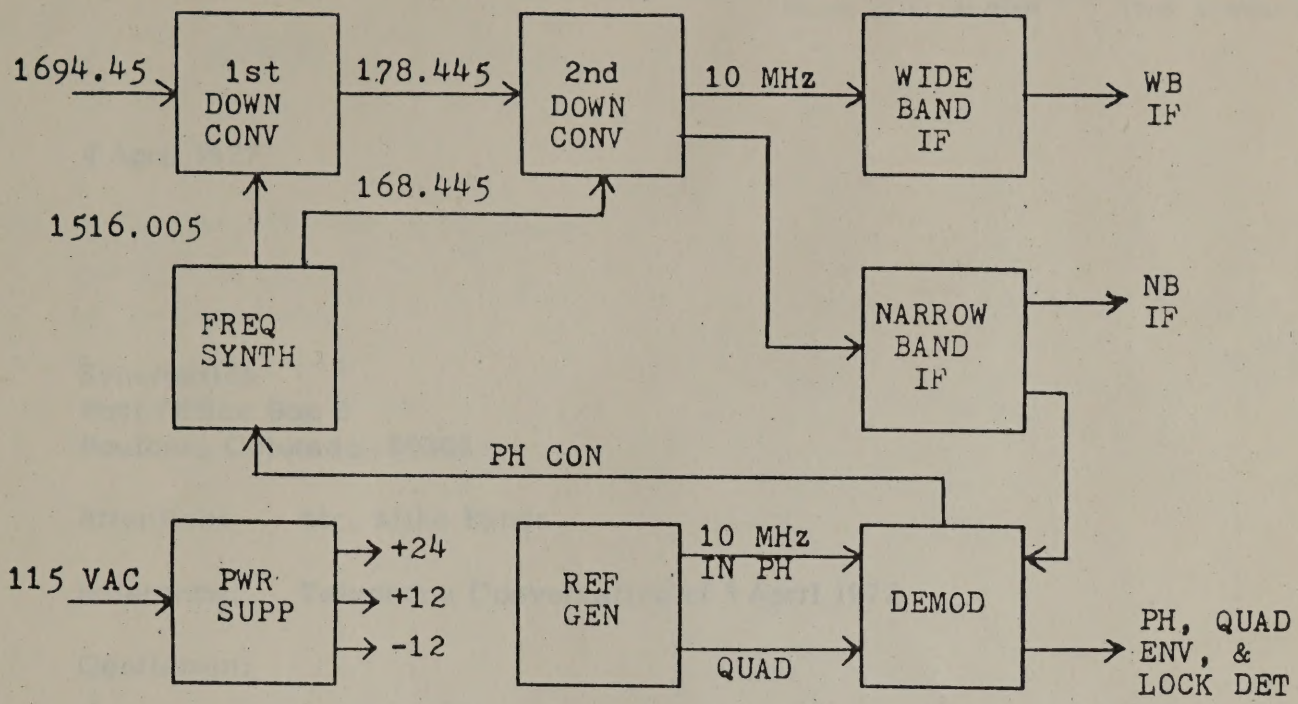


The Model PR-1000 is a desk top/rack mounting, self-contained, AC powered telemetry receiver. It will acquire and track signals at 1694.45 MHz, and produce 10 MHz IF outputs accurate to within one part per million. Two IF output bandwidths are provided, so that the carrier of one channel may be acquired in the narrowband IF, and the adjacent channels in the wideband IF offset accordingly to feed an external bank of channel demodulators. Demodulated outputs of the acquired signals are also provided. This receiver has automatic sweep acquisition, with manual override, and an aural monitor. A meter indicates the search frequency, and a lock indicator lights when acquisition is acheived.

BLACK CANYON STAGE • BOX 506 • PHOENIX, AZ. 85020 • 602/465-7735



SMS/GOES
DCP CHANNELS
PHASELOCK RECEIVERS



SPECIFICATIONS

PHASELOCK RECEIVER — **Model PR-1000**

Input Center Frequency.....	1694.45	MHz
Capture Range.....	±150	KHz
Acquisition: Automatic Sweep with Manual Override & Aural Monitor.		
Noise Figure.....	3	db
Image Rejection.....	20	db
Loop Bandwidth.....	200	Hz
Narrowband IF Bandwidth.....	2	KHz
Wideband IF Bandwidth.....	600	KHz
IF Output Frequency.....	10 MHz ±10	Hz
IF Output Level.....	-10 ±3	dbm
Demodulated Outputs: Phase, Quadrature, & Envelope Detection.		
Built-In Reference Oscillator:		
Accuracy vs Temperature, +27 ±12°C	±1	ppm
Aging Rate, per year	±1	ppm
Mech Adjust Range	±10	ppm

Options Available:

- Antenna Mounting Front End
- Other Operating Frequencies
- Built-In Test Equipment

AYDIN MONITOR SYSTEMS
401 Commerce Drive Fort Washington, Pa. 19034
Phone: (215) 646-8100 TWX: 510-661-1520

4 April 1977

Synergetics
Post Office Box E
Boulder, Colorado 80306

Attention: Mr. Mike Exner

Reference: Telephone Conversation of 1 April 1977

Gentlemen:

As per our recent telephone conversation, enclosed please find two copies of our Short Form Catalog, along with two copies of our technical information bulletin on the Model 342 PM Demodulator/PCM Synchronizer.

If you have any questions or require additional information, please do not hesitate to contact our local representative, Mr. Don Pond at (303) 798-2904, or the undersigned.

Very truly yours,

AYDIN MONITOR SYSTEMS

Robert J. Clegg

Robert J. Clegg
Product Line Manager

RJC/sh

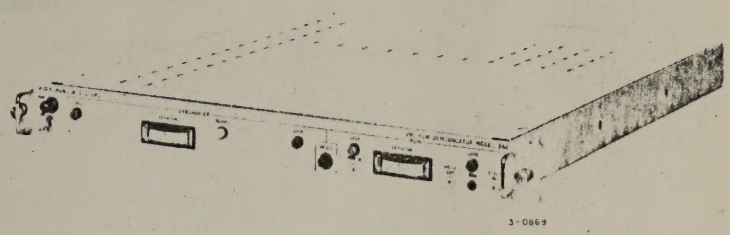
Enclosures

cc: D. Pond

AYDIN SYSTEMS

342 PM DEMODULATOR/PCM SYNCHRONIZER

- o 10 MHz Carrier Input
- o 400 Hz Input Bandwidth
- o Direct Phase Demodulation
- o Completely Automatic Operation
- o Outputs Reconstructed PCM and Clock



FUNCTION

The AYDIN MONITOR Systems Model 342 PM Demodulator is a unit designed specifically to synchronously demodulate and bit detect the PCM data from the Data Collection Platforms (DCP) used in the GOES system.

The Model 342 extracts the PCM data stream from a frequency multiplex containing up to 150 channels of DCP data being transmitted simultaneously. The overall design philosophy used in the Model 342 is to synchronously demodulate the individual DCP channels immediately at the 10 MHz (2nd IF) linear output port of the receiver. This technique has been used successfully in the Model 329 PSK Demodulator and has proven to give superior performance against units using down conversion and the associated problems involving image rejection.

Since consideration must be given to the possibility that any of the 150 channels may have to be demodulated and that these channels are not adjacent, MONITOR systems designed the Model 342 to demodulate any of the DCP channels independently, and that the channel selection be implemented without a major inpact on price or compromises in performance.

The assigned frequency of the DCP channel will be in the range of 9.850-10.150 MHz and will enter the Model 342 along with the other DCP channels present in the frequency multiplex. The signal is then filtered by a bandpass filter with a bandwidth sufficient to reduce the dynamic range required of the PM Demodulator.

The PM Demodulator extracts the baseband PCM signal from the carrier by first generating a phase coherent clock during the unmodulated carrier portion of the preamble and maintaining this phase during the message burst. Demodulation is then accomplished by multiplying this reference clock phase times the phase modulated input carrier.

The output of the PM Demodulator is the baseband BiØL PCM code plus in-band noise that must be further processed by the PCM bit synchronizer section. A phase coherent bit clock is internally generated and is used to synchronously demodulate the BIØL code, detect the bit value and output the reconstructed data as NRZ-L code.

OPERATION

The Model 342 is operationally self-contained and it can operate directly with the receiver. All outputs are TTL compatible and provide data, clock and status lines for use by the formatting equipment that follows the Model 342.

The Model 342 is completely automatic in its operation and therefore requires no operator controls except the power switch. A master reset switch is provided as a convenience for system troubleshooting but is not necessary for normal operation.

The front panel indicators are divided between the carrier and PCM sections. LOSS indicates that no carrier is being received; SEARCH indicates that the demodulator is sweeping the local oscillator within the ±500 Hz acquisition range of the unit. LOCK when illuminated shows the operator that the Model 342 has acquired phase lock to the incoming carrier. Similar indicators in the PCM section monitor the status of the baseband PCM signal. The null indicators are used to monitor the D.C. stress on the carrier and PCM phase locked loops.

ORDERING INFORMATION

Order Number: 342 with following suffixes –

Suffix	Specifies	Additional Charge
-10	Carrier (specify frequency)	No
-20	Bit Rate (specify bit rate)	No
-31	Setup assistance	Yes
-40	Non-tilting chassis slides	No
-41	Tilting chassis slides	Not Available
-42	No chassis slides	No
-90	108–132 vac, 47–63 Hz, single phase power	No
-91	108–132 vac, 360–440 Hz, single phase power	Yes
-92	230 vac, 47–53 Hz, single phase power	Yes
-25526	Paint color, Federal Standard 595	No
-ZZZZZ	Paint color, any other	Yes

Ordering Example: 342-10(9.967923 MHz)-20(100 Bps)-31-40-90-25526.

All AYDIN MONITOR Systems product information is augmented by detailed Procurement Specifications and in-depth engineering/sales support. Call or write to AYDIN MONITOR Systems if this assistance is desired.

AYDIN Systems

AYDIN VECTOR Division

Friends Lane, P.O. Box 328 Phone: (215) 968-4271
Newtown, Pa. 18940 TWX: 510-667-2320

Ruggedized Airborne Components & Systems
Transmitters...Commutators...PCM Encoders
Subcarrier Oscillators...Telemetry Systems

DATA SHEET - BAY TECHNICAL ASSOCIATES - DEMODULATOR

BAY TECHNICAL ASSOCIATES, inc.
8 COLONIAL PLAZA · BAY SAINT LOUIS · MISSISSIPPI · 39520
P.O. BOX 1324 (601) 467-8231

Mr. Mike Exner
Bureau of Land Management
C/O Syergetics
Box E Boulder Colo.

Dear Mr. Exner;

In response to your inquiry, Bay Technical Associates is pleased to send the attached technical specification for a multi-channel GOES Data Collection System Demodulator. The unit accepts the base-band from any suitable GOES receiver, and provides a serial output easily interfaced with convential computer processors. We do manufacture a single channel version of the SDM-2A that is used principally with command receivers in the Data Collection Platform remote location. The model # for this version is SDM-4 and is priced in single quantities at $6000.00. Although we are not now prepared to provide a quotation for an entire ground station, we would be happy to work with you to derive a suitable design and provide installation services. Whenever possible, we tend to recommend a smaller 16 or 18 ft. diameter dish to minimized pointing problems. Our technical personnel will be happy to discuss the technical details at any time that is mutually convenient.

Sincerely,
Bay Technical Associates
James A. Shull
James A. Shull
Mgr. Mkt.

TECHNICAL SPECIFICATION

GOES DATA COLLECTION SYSTEM

CHANNEL DEMODULATOR

MODEL SDM-2A

MANUFACTURED BY

BAY TECHNICAL ASSOCIATES

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1.0 Mechanical Layout (Figure 1.0)

1.0 INTRODUCTION

BAY TECHNICAL ASSOCIATES introduces an improved GOES Data Collection System Channel Demodulator Model SDM-2A. This unit performs to the same rigid technical specifications as previously constructed units which have demonstrated performance characteristics superior to comparable models within the same price range. Additionally, an improved mechanical and electrical design approach allows for expansion of data channels should added capability be required after initial installation.

2.0 PHYSICAL DESCRIPTION

The Model SDM-2A is more than just a phase modulation signal detector. This unit combines in one mechanical assembly three functionally separate sub-assemblies normally obtained from independent sources. These sub-assemblies provide for input data simulation, signal demodulation and synchronization, and channel data multiplexing for interfacing with various processors. The Simulator, Multiplexer, and Power Supply sub-assemblies are constructed as integral parts of the basic mechanical assembly. Channel Demodulator sub-assemblies are designed for independent operation which provides an expansion capability. (Figure 1) Controls for Simulator operation, lock indicators for channel acquisition, and power on-off switch are mounted on the front pannel.

2.1 SIMULATOR

Activation of the Channel Data Simulator automatically switches a sequence of low level signals at the input to each Channel Demodulator. Simulator controls are hexadecimal thumb-wheels for ease of entry of identification and data words. This sub-assembly eliminates the need for complex test equipment performing as an automatic self check function during periodic diagnostic testing and corrective maintenance of hardware and software.

2.2 CHANNEL DEMODULATOR

The Channel Demodulator sub-assembly combines narrow band filtering and phase lock loop detection improving the systems ability to automatically acquire and remain locked to extremely weak signal transmissions. Further optimization of data selectivity and noise rejection is gained through the use of a unique design for statistically selecting the binary logic levels of the detected PCM bit stream. Channel Demodulators are identical except for the specified center frequency of operation. The SDM-2A, expandable up to 8 channels, is easily modified after initial installation by simply plugging in additional sub-assemblies.

2.3 MULTIPLEXER

Upon receiving valid coded commands for the presence and satisfactory detection of a Data Collection Platform transmission, data is transferred from each Channel Demodulator into independent memory cells within the Multiplexer. The Multiplexer synchronizes, and time sequentially serializes the output of the Channel Demodulators for transfer to the processor interface unit. This output signal format is compatible with all Data General Nova 800 and 1200 series computers with the use of a standard interface unit designed for the Nova series by BAY TECHNICAL ASSOCIATES. Other optional output signal formats are available which are compatible with Electronic Industry Association RS-232C standard specification.

2.4 GENERAL

The SDM-2A is designed for unattended operation requiring no special set-up or operating procedures. The assembly is easily installed by connecting a single signal cable to the S-BAND receiver output and a single signal cable to the processor interface unit. After power is applied the system is ready for operation.

3.0 MECHANICAL SPECIFICATIONS

3,1 Input connector
Single coaxial connector type BNC

3.2 Output connector
MS type three pin using shielded twisted pair cable

3.3 Pannel indicators
Light emitting diodes for lock indicators and simulator channel designator

3.4 Physical demensions
Width - 19 inch compatible with standard instrumentation racks
Height - 5¼ inches
Depth - 24 inches

4.0 ELECTRICAL SPECIFICATIONS

4.1 Input power
115 VAC - .5 Amphere

4.2 Input voltage range
.1 VRMS to 1VRMS

4.3 Input frequency range
10 MEG HZ +150 K HZ -150 K HZ

4.4 Input impedance
50 OHMS

4.5 Acquisition sensitivity
Acquisition threshold occurs minimum 26 DB below ambient noise at 300 K HZ bandwidth

4.6 Detector type
Phase lock with automatic acquisition control

4.7 Adjacent channel rejection
Adjacent channel noise interference not detectable as message errors with input signal differential up to 65 DB

4.8 Output data format
Serial bipolar balanced line

4.9 Output data transfer rate
20 K HZ

4.10 Bit error rate
No greater than 1 in 10^6 message errors for a composite signal plus noise to noise of 6 DB at 300 HZ bandwidth

4.11 Multiplexer storage capacity
4096 bits per data channel (greater if specified)

5.0 PRICING AND DELIVERY

5.1 Basic assembly consisting of Chasis, Simulator, Multiplexer, and power supply for operating up to 8 channels.....$8200.00

5.2 Channel Demodulator sub-assemblies each.....$4400.00

5.3 Delivery
Complete assembly ready for shipment from the manufacturing facility 5 months after receipt of order to proceed

Included with the assembly 2 copies of installation instructions and operator's manual

6.0 MAINTENANCE AND SPARING

Warranty Provision

The SDM-2A is warranted against component infant mortality and latent defects of manufacture for a period of 6 months after delivery. Upon return to the manufacturing facility BAY TECHNICAL ASSOCIATES will repair and test the unit for proper operation at no additional cost.

Repairs made after the end of the warranty period will be priced according to component cost plus a nominal fee for actual labor.

Sparing provision

BAY TECHNICAL ASSOCIATES will maintain at the manufacturing facility, a nominal stock reserve of components required

*Note price quotations valid for 30 days after submittal

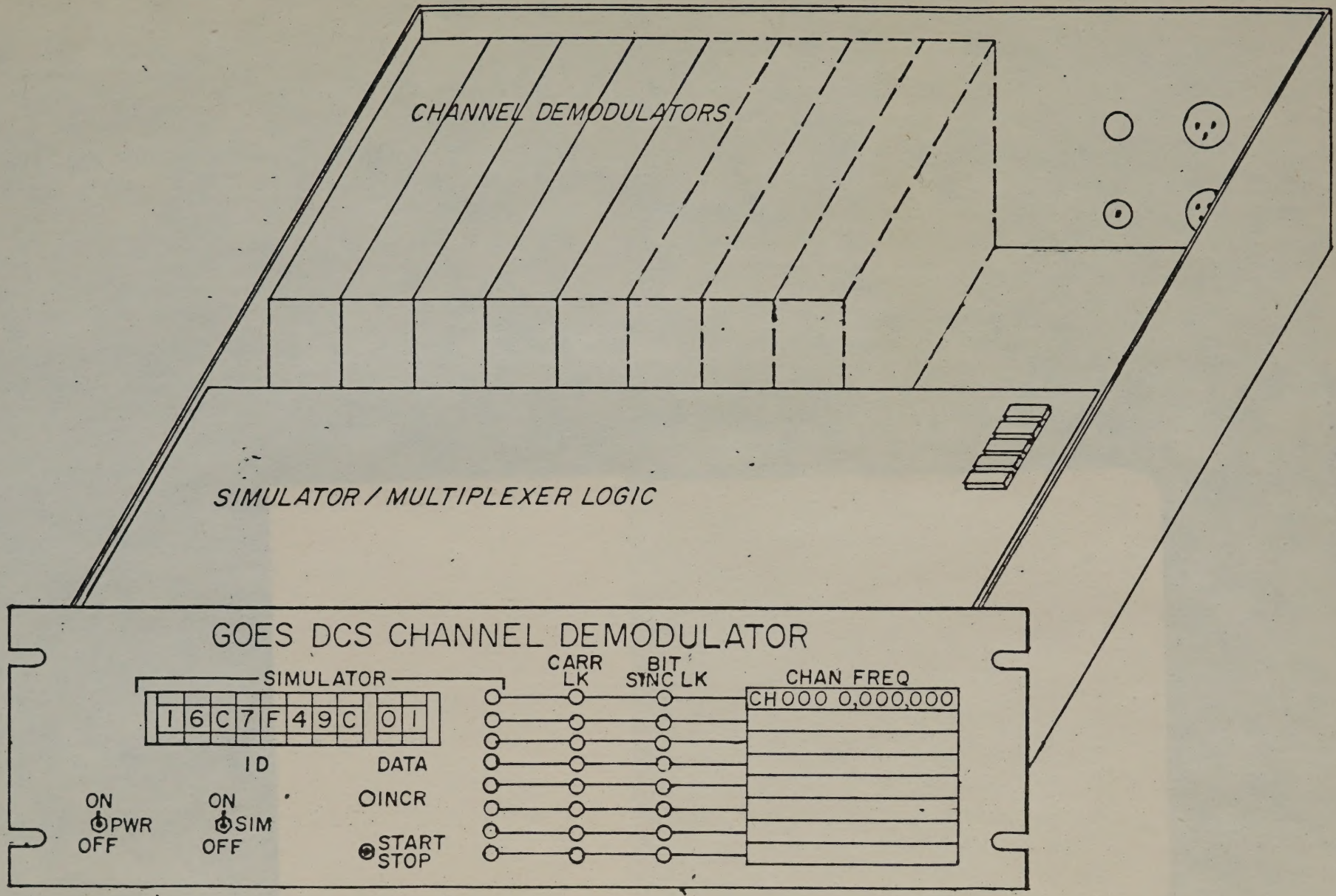
CHANNEL DEMODULATORS
SIMULATOR / MULTIPLEXER LOGIC
GOES DCS CHANNEL DEMODULATOR
SIMULATOR
1 6 C 7 F 4 9 C
0 1
ID
DATA
ON
PWR
OFF
ON
SIM
OFF
INCR
START
STOP
CARR LK
BIT SYNC LK
CHAN FREQ
CH 000 0,000,000

FIGURE 1